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Executive Leadership

Engine Resource Typing Definitions: Are the Current FEMA Engine Resource Typing Definitions Definitive of the Engines in Cuyahoga County, Ohio?

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Abstract

The problem was the Brecksville, Ohio, Fire Department and its neighboring communities did not have any engines (pumpers) that qualified under the FEMA 508-4 engine typing definition. The purpose was to examine the engine attributes of other engines within Cuyahoga County, Ohio, to determine if the FEMA engine typing definitions were definitive of other engines within the county. Descriptive research was used to examine the attributes of engines within the county, the requirement of engines at mutual aid incidents and to compare the county mutual aid responses to that of the State of Ohio. The results suggested the FEMA 508-4 engine typing definitions were not definitive of engines within Cuyahoga County. Recommendations included more comprehensive research on major urban mutual aid events, and revision of the current typing system to be reflective of the 1998 NWCG definitions.

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Introduction

The Brecksville Fire Department recently completed typing fire resources in accordance with Federal Emergency Management Agency (FEMA) 508-4 Typed Resource Definitions – Fire and Hazardous Materials Resources, dated July 7, 2005. After completion it was found that both of the department's engines failed to qualify under any of the typing definitions. In discussion with neighboring Fire Chiefs, Lee Ippolito from the City of Broadview Heights and Peter Nelson from the City of Independence, similar circumstances were found for their respective cities.

The problem is the resource typing definition for engines (pumpers) as published by the National Integration Center; Incident Management Systems Division requires one inch hose in all of the engine (pumper) typing definitions. This requirement may be preventing many engines in our area from qualifying under any of the typing definitions.

The purpose of this research is to determine whether the current engine (pumper) typing definitions are definitive of engines (pumpers) in Cuyahoga County, Ohio.

The questions that will be examined in this paper are:

What are the current configurations of engines in Cuyahoga County, Ohio?

How do the current configurations compare with the established FEMA engine (pumper) typing definitions?

What have been the requirements of engines when responding to major events involving three or more mutual aid jurisdictions in Cuyahoga County, Ohio?

How do the mutual aid engine responses in Cuyahoga County compare to the rest of the State of Ohio?

Descriptive research will be the primary method used in the formation of this paper.

Background and Significance

The City of Brecksville is located on the southern most border of Cuyahoga County in Northeast Ohio. The community lies approximately 15 miles due south from the heart of downtown Cleveland, Ohio. The incorporated city covers 19.62 square miles (U.S. Census Bureau, 2008a). According to the United States Census Bureau, the 2007 estimated population of the city is 12,957 (U.S. Census Bureau, 2008b).

The Brecksville Fire Department is a combination fire department consisting of 15 full-time firefighters and 1 chief supported by 25 part-time firefighters. The department is staffed 24/7 by five members and handles fire, EMS and rescue requests. In addition, the department serves as a partner in a 19 member regional multi-discipline team for hazardous material

responses, water based rescues, trench rescues, high angle rope rescues and fire investigations.

The City of Brecksville is 1 of 59 community governments in Cuyahoga County, Ohio (Cuyahoga County, 2008). These communities vary greatly in both size and population, from the City of Cleveland, population 478,403, to the Village of Linndale population 117 (U.S. Census Bureau, 2000a). As defined by the 2000 census (U.S. Census Bureau, 2000b) of the 11,353,140 people in Ohio, Cuyahoga County accounts for 1,393,978 or approximately 12.28% of the state's population earning the distinction of the most populated county in Ohio.

The local communities are grouped by geographical locations into planning regions within the county. The Brecksville Fire Department is one of eight communities in the Cuyahoga Valley Region.

Mutual aid is a critical component of fire department operations in the Cuyahoga Valley Region. Of the eight communities, only the Broadview Heights Fire Department staffs two stations. The remaining seven communities operate out of one station per community.

All building fires in the Cuyahoga Valley Region generate at least one mutual aid engine response from a neighboring community. The FEMA 508-4 Typed Resource Definition for an engine, as written, cannot be utilized effectively in a Mutual

Aid Box Alarm (MABA) for the Cuyahoga Valley Region. Therefore, possible disparities between actual engine configurations and the current configurations as defined in the FEMA 508-4 could inhibit the adaptation and implementation of the typing system for engines, thereby impacting the future organizational effectiveness for the Cuyahoga Valley Region and other regions throughout Cuyahoga County, Ohio.

Determining whether the FEMA engine typing definitions are definitive of engines in Cuyahoga County directly relates to adaptive change as discussed in the National Fire Academy's (NFA) Executive Leadership course, unit 6 (National Fire Academy, 2004).

Research on how engines were utilized at major mutual aid events and a comparative analysis between actual engines and the FEMA 508-4 Typed Resource Definition for an engine coincides with the United States Fire Administration operational objective, "To respond appropriately in a timely manner to emerging issues."(National Fire Academy, 2008, p. II-2). The typing of engines in accordance with the NIMS resource typing guide lines is a relatively new issue for local communities. Minimal information exists regarding studies of the typing system as it relates to engines in the urban environment.

Literature Review

Cuyahoga County Fire Departments

The Ohio Fire Marshal's Office lists 51 fire departments for Cuyahoga County in the *Ohio Fire Department Directory 2005* (Ohio Department of Commerce, 2005). Although not listed under Cuyahoga County in the *Ohio Fire Department Directory 2005*, the Cleveland Hopkins International Airport Fire Department does reside in the county and is assigned the fire department identification number 18-300 (Chief Zemek, personal communication, September 23, 2008). The communities of Walton Hills, Glenwillow, Hunting Valley, Chagrin Falls Township, Bentleyville, Moreland Hills, Bratenahl and Linndale have fire protection provided by other communities.

The fire departments in the county are grouped geographically into nine planning districts (see Appendix A) by their respective communities (Cuyahoga County Emergency Management Agency, 2008).

National Incident Management Resource Typing

The National Integration Center (NIC) stresses the fact that resource typing is a part of NIMS. Resource typing is cited as an important part of resource management, which is one of the components of NIMS (NIC, 2008).

One of the questions listed in the Frequently Asked Questions section regarding resource Management and Credentialing is "Does that mean we are supposed to do our own resource typing, or what?" The answer given is "No, you should

not start ‘typing’ your resources”. However, the answer does go on to encourage communities to “…use the resource typing definitions to describe and inventory their resources…” (FEMA, NIMS Resources, Frequently Asked Questions, Resource Typing, Question 10, June 3, 2008). Kyle Blackman, Chief of Resource Planning and Coordination Branch, NIC, encourages everyone to utilize the NIMS typing terminology so that when an emergency arises there is no confusion as to what to call the resource. (Homeland Responder, 2007) The concept of incorporating the resource typing terminology “…into your daily emergency management activities and operating procedures” is also reflected in *Resource Typing* (NIC, 2005, July p.2)

The frequently asked questions document also states “…definitions were created to reflect the resources that are most commonly exchanged via mutual aid during a disaster, not resources for routine day-to-day emergency response operations.” (FEMA, NIMS Resources, Frequently Asked Questions, Resource Typing, Question 7, June 3, 2008)

Compliance Objective 20 in *FY 2008 NIMS Compliance Objectives and Metrics for Local Governments* (FEMA, March, 2008a) assesses compliance for inventorying response assets and conformity to the NIMS typing definitions in questions 20.1 through 20.3. Questions 20.1 and 20.2 inquire as to whether or not local governments have inventoried and typed their assets to

conform to National Resource Typing Definitions. Question 20.3 inquires as to whether or not a process has been established for determining availability of the assets. These questions require an answer when completing the National Incident Management System Compliance Assistance Support Tool (NIMSCAST).

NIMS ICS-200.A (FEMA 2008b) training teaches students "Resources type refers to the level of resource capability" (p. 6-17). Both the student manual and the instructor guide emphasize Type I resources are to have a greater capability than Type II resources. In addition, FEMA 501-9 *NIMS Basic* (FEMA, 2006), further explains that type assessment "is based upon a minimum level of capability described by the identified metrics for that resource or component" (p.6). In addition, the *NIMS Basic* document defines "metrics" as the measurement component of capability or capacity.

The National Response Framework (NRF) (Homeland Security, 2008) has firefighting as Emergency Support Function four (ESF-#4). The coordinating agency for this ESF is the Department of Agriculture, specifically the U.S. Forest Service. The two primary responsibilities of this ESF are "Coordination of Federal firefighting activities" and "Support to wildland, rural, and urban firefighting activities" (p. 58).

Engines (pumpers) typing definitions are defined in *Typed Resource Definitions: Fire and Hazardous materials Resources,*

FEMA 508-4, ((FEMA, 2005) Appendix B). Currently, five typing classifications are listed, Type I through Type IV and Other. The five metrics used for measuring capabilities and capacities are pump capacity, tank capacity, hose 2.5 inch, hose 1.5 inch, hose 1 inch, and personnel. Pump capacity, hose 2.5 inch and personnel metrics all reflect the greatest capacities for Type I. Interestingly the 1.5 inch and 1 inch hose have the greatest capacities for Type III while the tank capacity metric is greatest for Type IV.

The comments section of FEMA 508-4 states “The engine typing needs to be taken out to Type VII. Compromise between FIRESCOPE and NWCG is to use NWCG Standards for Engines and Crews. NWCG has seven engine types” (p. 7).

Other Resource Typing Definitions

The National Fire Protection Association (NFPA) sets a minimum pump capacity of 750 gpm for pumper fire apparatus, 250 gpm for initial attack pumpers and 1,000 gpm for quints (NFPA, 2007). Minimum requirements for water tanks are 300 gallons for the pumper, 200 gallons for the initial attack apparatus and 300 gallons for the quint. The standard sets a minimum requirement of 400 feet of 1.5 inch or 1.75 inch 2 inch hose and an 800 foot requirement of 2.5 inch or larger hose for the pumper. The only difference in the hose requirements for the initial attack pumper is the reduction of the 2.5 inch and over hose, to 300

feet. The minimum requirements for hose on the quint are identical to that of the pumper (NFPA, 2007)

Insurance Services Office (ISO) has no set pump capacities. A community's "Basic Fire Flow" is first determined by a multitude of factors. The Basic Fire Flow is then used as the basis for determining pump capacity, number of needed engines and other equipment that may be needed. (ISO, 2008a) ISO does set needed requirements for booster tanks and provides equivalencies for other items such as hose and appliances (see Appendix C). ISO requires a minimum of 300 gallons or larger for booster tanks. The 200 foot booster hose requirement can be fulfilled with preconnected 1.5 inch or 1.75 inch hose. The 400 foot 1.5 inch hose requirement can be substituted with 1.75 inch or 2 inch hose. The requirement for 2.5 inch hose or larger is 1,200 feet. ISO does have a master stream requirement of 1,000 gpm for Basic Fire Flows of 1,500 gpm or greater. This requirement can be achieved with a portable or mounted appliance.

Firefighting Resources of California Organized for Potential Emergencies (FIRESCOPE) meets all the FEMA 508-4 requirements. However, FIRESCOPE (2007) does have additional metrics for a 20 foot extension ladder in Type I and II and a 500 gpm master stream requirement for Type I (Appendix D).

The State of Alaska *Supplemental Engine Requirements (*Alaska, State of, 2006) types wildland engines from T-3 to T-7 (see Appendix E). Of significant note is the metrics utilized in this table differ from that of the FEMA 508-4 in that a “Pump Rated Pressure (psi)” is an added metric (p.1). In addition, all the assigned values differ for T-3 from that of the FEMA Type III. Consistency is, however, present in T-4 and FEMA Type IV for three of the six metrics values: hose 1.5 inch, hose 1 inch, and personnel.

The State of Colorado, Department of Public Safety’s publication *Fire/Hazmat Resources (*Colorado, State of, n.d.) utilizes the same metrics and values as FEMA 508-4 (see Appendix F) however, the typing classifications are extended out to Type VII (p.10). This may be an outdated document in that there is no date provided on the document and it is consistent with that of Table 2 provided by Phillips (2005, January).

Other documents found predating the July, 2005 FEMA 508-4 *Typed Resource Definitions* were *Engine Dispatch Operations Guide* authored by Northern Front Range Interagency Wildland Fire Cooperators (2003) and *Equipping Fire Apparatus for Use in the Wildland Interface* by NWCG (1998). As depicted in Appendix G and H respectively, additional metrics are provided for flow at rated pressure (psi), ladders, and master stream flows. Flow at rated pressure is 150 psi for Type I and Type II. Type III

requires rated pressure to be a minimum of 250 psi. The remaining types only require rated pressure to be 100 psi. A 48 foot ladder requirement is present in both documents for only Type I and Type II engines. The 500 gpm master stream requirement is only present for the Type I engine. Both of the aforementioned documents have no 1 inch hose requirements for Type I and Type II engines. The NWCG (1998) typing chart categorizes Type I and Type II as “Structural Engines” and type III through VII as “Wildland Engines” (p.4).

Major Mutual Aid Engines Events

A major mutual aid event occurred in Maple Heights, Ohio, on March 11, 2002, at the major intersection of Lee and Libby Roads. Plunket (2002) reports the incident was a result of a 20-inch natural gas transmission line leak. The incident reportedly summoned 13 mutual aid communities deploying 20 total companies with 112 firefighters for a total of five hours. Significant engine attributes mentioned were the deployment of 2.5 inch lines for blitz attack and unmanned portable monitor deployment. In addition, Plunket mentions the deployment of pre-piped deck guns on exposures.

The City of Garfield Heights, Ohio, responded to a magnesium recycling plant fire on December 29, 2003. Bradish (2004) reports 18 departments responded with a total of 193 personnel. Thirteen engines and five aerial apparatus were

utilized. Significant engine attributes cited were the use of deck guns, portable monitors, and four inch hose. Relay pumping played a major roll in both supplying aerial apparatus and supplying water from different water grids. One of the relay operations mentioned supplying water from a 1,700 foot distance. In addition, one of the engines reported their flow meter indicated a flow of over one million gallons.

Sabo (2008) reports a train derailment in Painesville, Ohio, summoned 24 engines, 6 ladders, and 7 medic units with a personnel count of 135. Significant engine attributes mentioned were the use of unmanned master streams to cool a Liquefied Petroleum Gas (LPG) car.

Sheridan and Richter (2006) indicate most of the hydrant system was down after hurricane Katrina devastated New Orleans, Louisiana, in August of 2005. They state the need early on to acquire hard-suction hose to draft from tankers. Hampton and McConnell (2006) report “…the department was reduced to drafting water from the flooded streets…” (p.51) McCormack (2006) reports water tanker task force I worked with Engine 8 from New Orleans Fire Department, a “special drafting pumper from Illinois” (p.93) and six tanker pumpers. Their plan was to lay five inch supply line from an intersection to the fire. The drafting pumper would position at the intersection thereby allowing the tankers sufficient room for ingress and egress.

Other Studies

Coulombe (2006) researched NIMS typing for the area of Western Massachusetts. The results for the engine typing were 48 Type I engines were available from the 14 responses received. The average was 3 Type I engines per community. Coulombe indicates the Western Massachusetts area contains 101 communities.

The Coulombe (2006) research results for engines, indicates 100% compliance for those who responded, with a 13% participation rate of total communities. These findings raised the question as to whether only those in compliance with Type I engines may have responded. These findings significantly influenced the goal of obtaining 100% participation from the Cuyahoga County communities in this paper.

Procedures

Research began by conducting a search of the National Emergency Training Center, Learning Resource Center (LRC) for literature relating to NIMS resource typing. Additional searches were conducted for literature regarding major mutual aid events in Cuyahoga County.

In addition, internet search engines such as Google and Yahoo were utilized extensively to obtain additional information on NIMS and other resource typing for engines. These search engines were also useful in identification of community

information such as number of fire stations and the provider of fire protection when the community did not support their own service.

The primary source used to identify fire departments within Cuyahoga County was the Ohio Fire Department Directory (2005) as provided by the Ohio Fire Marshal's office. This document also provided the Fire Department Identification Number (FDID) for each community.

A request was made to the Ohio Fire Marshal's office for responses in Ohio that had three or more engines. This request netted one result. After personal communications with Cindi Pitzer, Records Management Supervisor, it was found that the information sought was not a standard generated report and would not generate the desired data as stated in the request. A special request needed to be submitted for a non-standard query with the precise parameters defined. The data requested was not one of the desired goals of the reporting system.

After review of the data reporting fields it was determined the primary fields required to attain the desired results were "Mutual Aid" = given and "Number of Engines" = equal to, or greater than one. The information was sought for calendar years 2003 through 2007. The five year time frame was chosen in an effort to ensure sufficient data to work with. The minimum data requested consisted of FDID number, date and time of incident,

incident location, and incident location zip code. Data for the entire state was requested to compare the types of mutual aid calls in Cuyahoga County to that of the State of Ohio as a whole. Based upon the aforementioned, a formal request was then submitted to the Ohio Fire Marshal's office (see Appendix I) for the special query.

The Special request was granted by the Ohio Fire Marshal's Office and the raw data transmitted via e-mail in an Excel format. Each year was sent independently due to the large volume of data contained within each file. The data received for mutual aid events for Ohio per year were as follows:

2003 – 4,577 2004 – 4,608

2005 – 6,549 2006 – 6,863

2007 – 7,836

The significant increase in 2005 over the previous two year events is attributed to non-electronic data reporting requirements prior to 2005. Events submitted on paper were not included for 2003 and 2004 data (Nathan Murphy, personal communications, August 2008). The lack of data from the non-electronic reporting does pose a consistency limitation. However, the extent of this limitation is unknown. The increase between years 2006 and 2007 can not be explained at this time.

The raw data as provided by the Ohio Fire Marshal's Office is not included in this document. Conversion of the Excel data

file, for year 2003, to a Word document resulted in 171 pages of information. Therefore, a sample of one page has been provided for 2007 (Appendix J). The data, however, can be provided electronically upon request.

The original data was copied onto additional work sheets within Excel for sorting and filtering processes so as not to corrupt original data. The original, sorted, and filtered data was maintained in a separate file by year. Information regarding Cuyahoga County Fire Departments was identifiable by the first two digits of the FDID number. All Fire Departments within Cuyahoga County begin with 18.

Determining multiple engine responses for Cuyahoga County proved more challenging than anticipated. Automated searches for duplicate entries, such as address, failed due to misspellings and the misuse of prefixes and suffixes by those originally entering the data. Therefore, the Cuyahoga County entries were sorted by date, then by time and manually reviewed.

Events that indicated three or more mutual aid engines had responded were copied and pasted to a new Excel file. Three or more mutual aid engines responding to an event usually transcends the standard everyday responses and depicts a larger scale event. As previously stated in the literature review, the resource definitions were not designed to define “routine day-to-day emergency response operations.” (FEMA, NIMS Resources,

Frequently Asked Questions, Resource Typing, Question 7, June 3, 2008). The three or more mutual aid engine response events were chosen for follow up with the Engine Attributes at Significant Events questionnaire.

The Engine Attributes at Significant Events questionnaire (Appendix K) was based upon the Engine Configuration questionnaire. The incident date and location were provided for the participant. Pump Size required a minimum value. The remaining elements could be answered with a “0”, “1”, or “2” relating to the significance of the engine attribute to the event. Questions relating to four and five inch hose were intentionally boxed to highlight the third option available, four or five inch hose. It was presumed the size of supply line used by the department may be automatically selected by the participant. Early results from the Engine Configuration questionnaire indicated a significant division between the use of four and five inch supply hose. The intent of providing the third option, of four or five inch hose, was to assess the significance participants placed upon five inch hose. The responses from the Engine Attributes at Significant Events questionnaire were entered into an Excel spreadsheet for tabulation.

The questions for the Engine Configuration questionnaire were based upon information obtained in the literature review

process. A questionnaire was drafted and taken to five fire stations. The initial questionnaire proved to be confusing and cumbersome to the participants. In addition, three out of the first five participants did not know with certainty the capacity of their booster tanks. Unlike the pump capacity, information that can be obtained on the information plate at the pump panel, no information plate on the vehicles was found to verify tank capacity. The questionnaire was redesigned to simplify the form and booster tank capacity was eliminated (Appendix L).

The FDID was requested for verification against the Ohio Fire Department Directory (2005). Number of stations and station number data was collected to ensure no stations were overlooked for the survey. Whereas, the intent of this document was not to type or render judgment upon any jurisdiction or to have this document used to that end, engine identification (what the unit is referred to on the air), manufacturer and manufacture date were collected for data identification purposes.

The engine identification was also used as the determining factor for inclusion or exclusion of quints as an engine in the data tabulations. Communities who identified their quints with an engine call number were included. Those who identified their quints with ladder call number were not included. Note: the term quint for this document refers to the basic components of pump, water tank, aerial device, ground ladders and fire hose.

Three options were provided for the monitor; fixed, portable and combination. A fixed monitor (deck gun) refers to a monitor that is pre-piped and solely operates from the engine. A portable monitor refers to a unit that is designed to operate off the engine on its own base. The combination monitor refers to a monitor that is fixed but can be removed from the engine and reattached to a base for operations.

Information regarding number of fire stations and locations of the stations within the community was obtained via internet searches and personal communications. The information collected was entered into a Microsoft Excel spreadsheet and then imported into Microsoft Streets and Trips 2002 to aid routings for on site data collection. Although many fire departments within the county list the locations of their facilities on their websites, the inclusion of every fire station’s exact location for the entire county into one public document would not be conducive to good security practices. Therefore, no fire station addresses have been included in this document. The reference map in Appendix M has been reduced and is provided solely as a procedural verification component.

In an effort to achieve 100% participation and to avoid limited participation as cited by Coulombe (2006) the questionnaires were completed via e-mail, fax, personal phone

calls and onsite visitations. The vast majority were completed through personal phone calls and on site visitations.

Data for mutual aid comparison between Cuyahoga County, Ohio, and the State of Ohio was obtained from the information provided from the Ohio Fire Marshal's Office. The Cuyahoga County data was extracted from the entire state data and calculated separately so as not to influence the remaining State of Ohio statistics.

Results

Information regarding engine configurations is based upon 131 engines from 105 fire stations located in 52 jurisdictions within Cuyahoga County, Ohio. Ten engines were quints and two were squirts. Data for all charts are provided in Appendix N.

Pump Capacity

The most popular pump capacity for engines in the county is the 1,500 gpm. This accounted for 68% of all engines. A distant second was the 2,000 gpm pump at 16%. A very close third, at 14%, is the 1,250 gpm pump. Only three engines or 2% were found to have a rated capacity of 750 gpm (Figure 1a and Figure 1b).

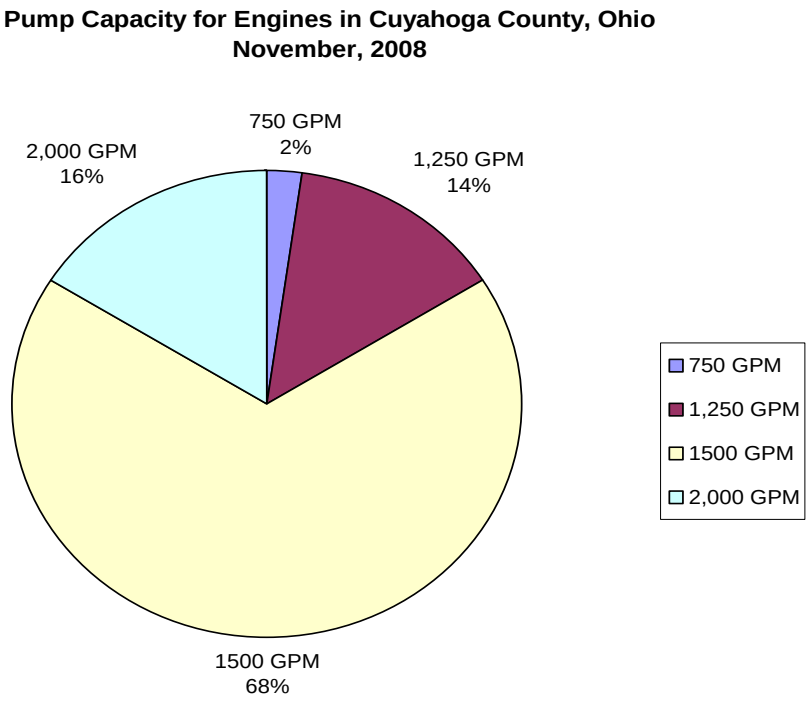


Figure 1a

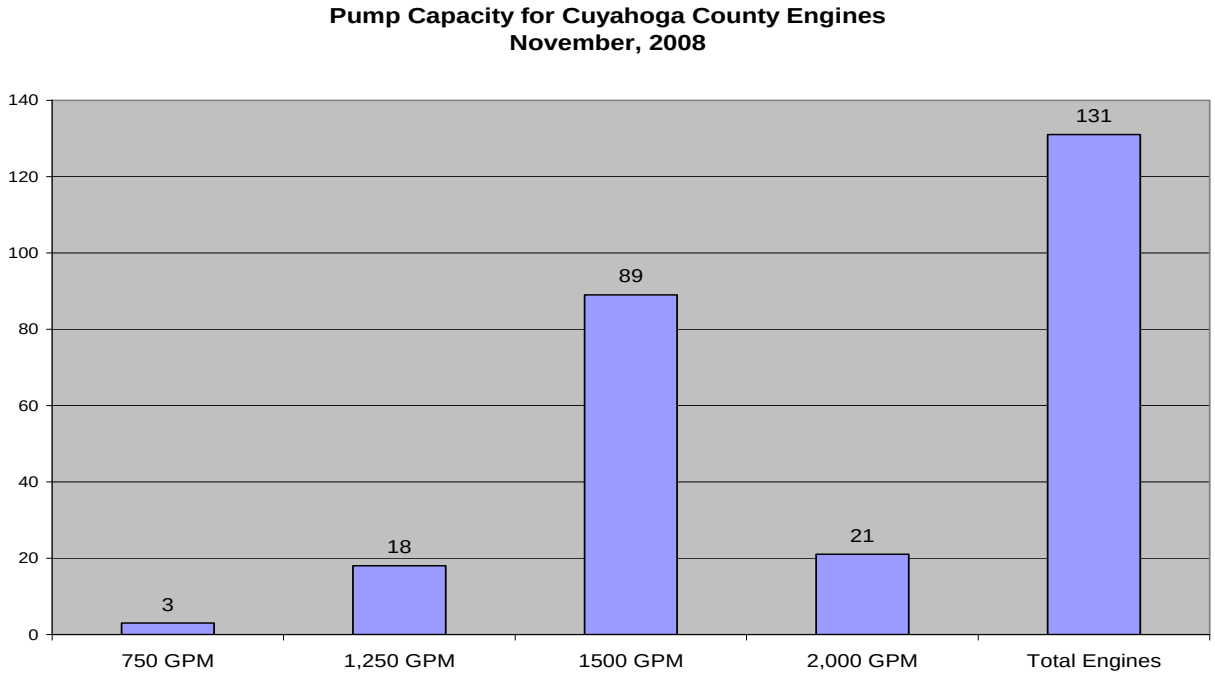


Figure 1b

Hose: 1 Inch

As demonstrated in Figures 2a and 2b, the vast majority of engines in Cuyahoga County do not carry 1 inch hose. By far the most popular 1 inch hose is the 200 foot booster reel. This configuration accounted for 24 of the 131 engines. The next closest configuration is the 100 foot booster reel carried by five engines. Many of the departments referred to their 1 inch hose lines as “trash lines” during the onsite data collection process.

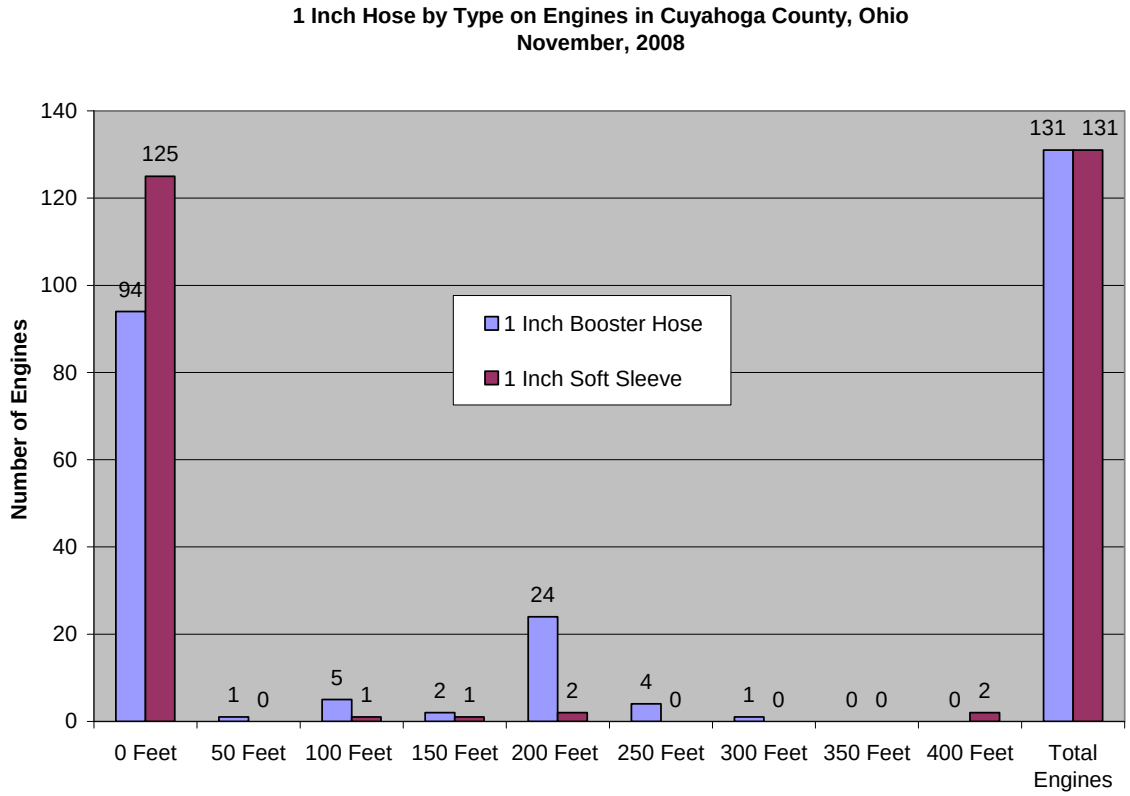


Figure 2a

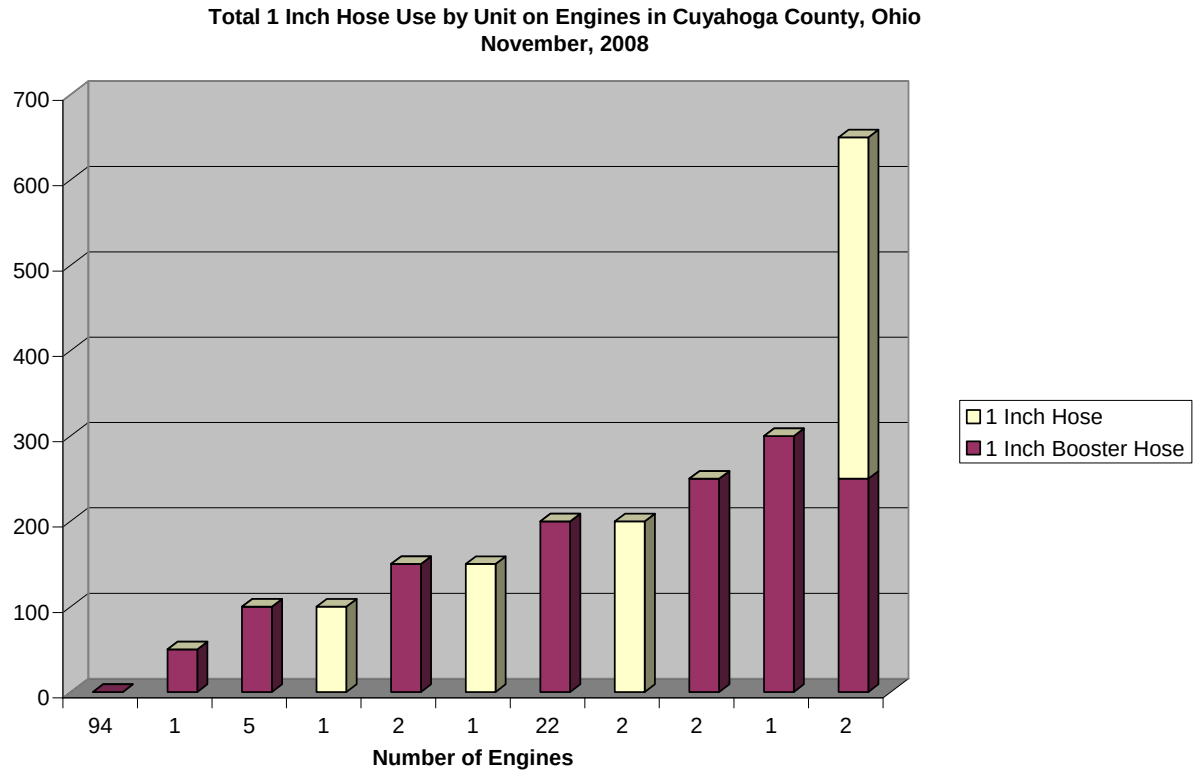


Figure 2b

Hose: 1.5 Inch, 1.75 Inch and 2 Inch

The vast majority of engines (102) within the county no longer carry 1.5 inch hose. By, far the attack line of choice has migrated to the 1.75 inch hose as depicted in Figure 3. Not only are more vehicles carrying 1.75 inch hose (129), they are also carrying much higher quantities. The majority of engines were found to carry between 500 to 1,100 feet of 1.75 inch hose. The 2 inch compliment of hose was found on 45 engines. When examining the total hose loads of 1.5 inch, 1.75 inch and 2 inch only one engine was found to have 400 feet total. The remaining engines had over 600 feet (Figure 4).

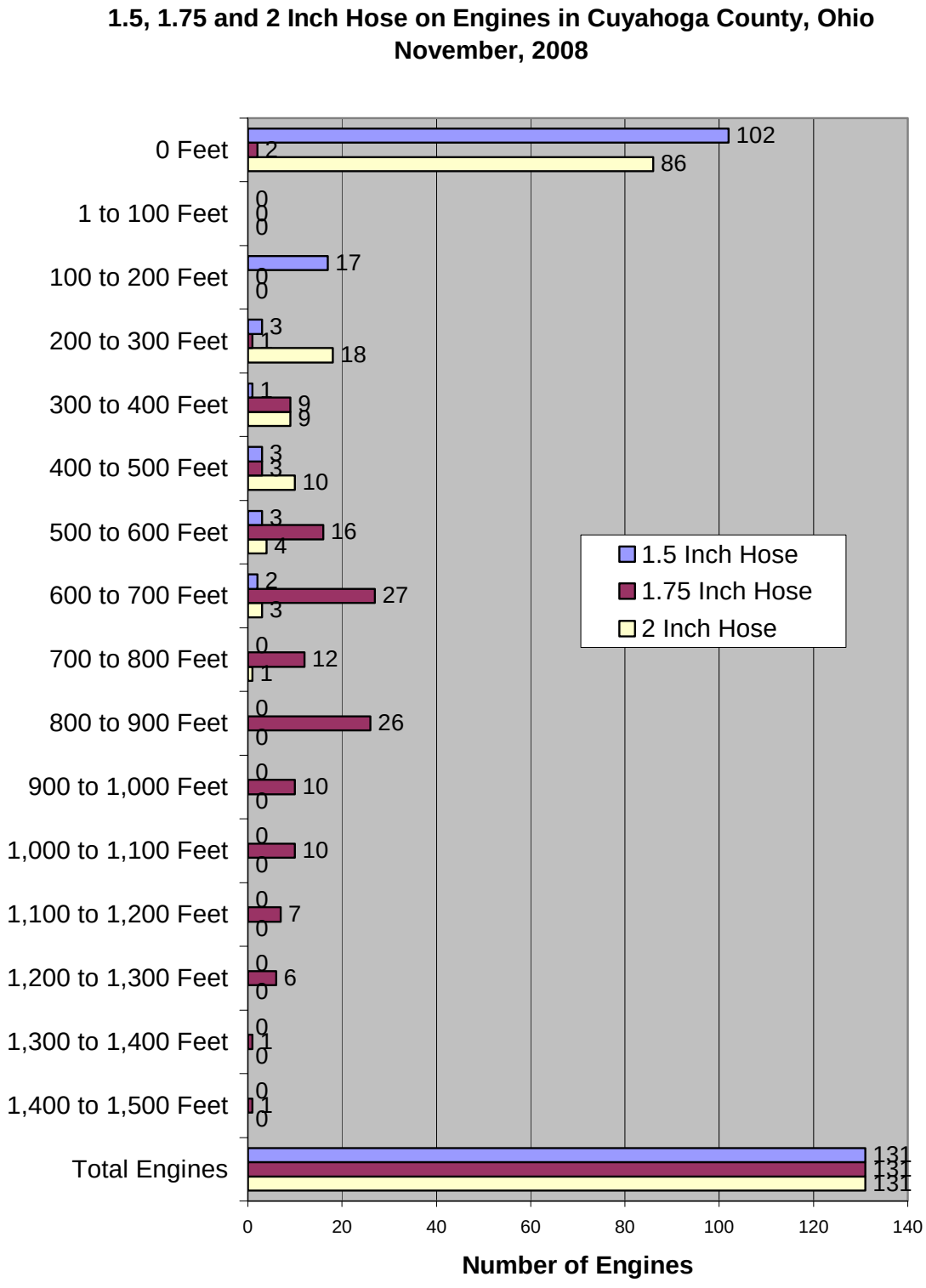

1.5, 1.75 and 2 Inch Hose on Engines in Cuyahoga County, Ohio
November, 2008
0 Feet
1 to 100 Feet
100 to 200 Feet
200 to 300 Feet
300 to 400 Feet
400 to 500 Feet
500 to 600 Feet
600 to 700 Feet
700 to 800 Feet
800 to 900 Feet
900 to 1,000 Feet
1,000 to 1,100 Feet
1,100 to 1,200 Feet
1,200 to 1,300 Feet
1,300 to 1,400 Feet
1,400 to 1,500 Feet
Total Engines
102
2
86
0
0
0
17
0
0
3
1
18
1
9
9
3
3
10
3
16
4
2
27
3
0
12
1
0
26
0
0
10
0
0
10
0
0
7
0
0
6
0
0
1
0
0
1
0
131
131
131
1.5 Inch Hose
1.75 Inch Hose
2 Inch Hose
0
20
40
60
80
100
120
140
Number of Engines

Figure 3

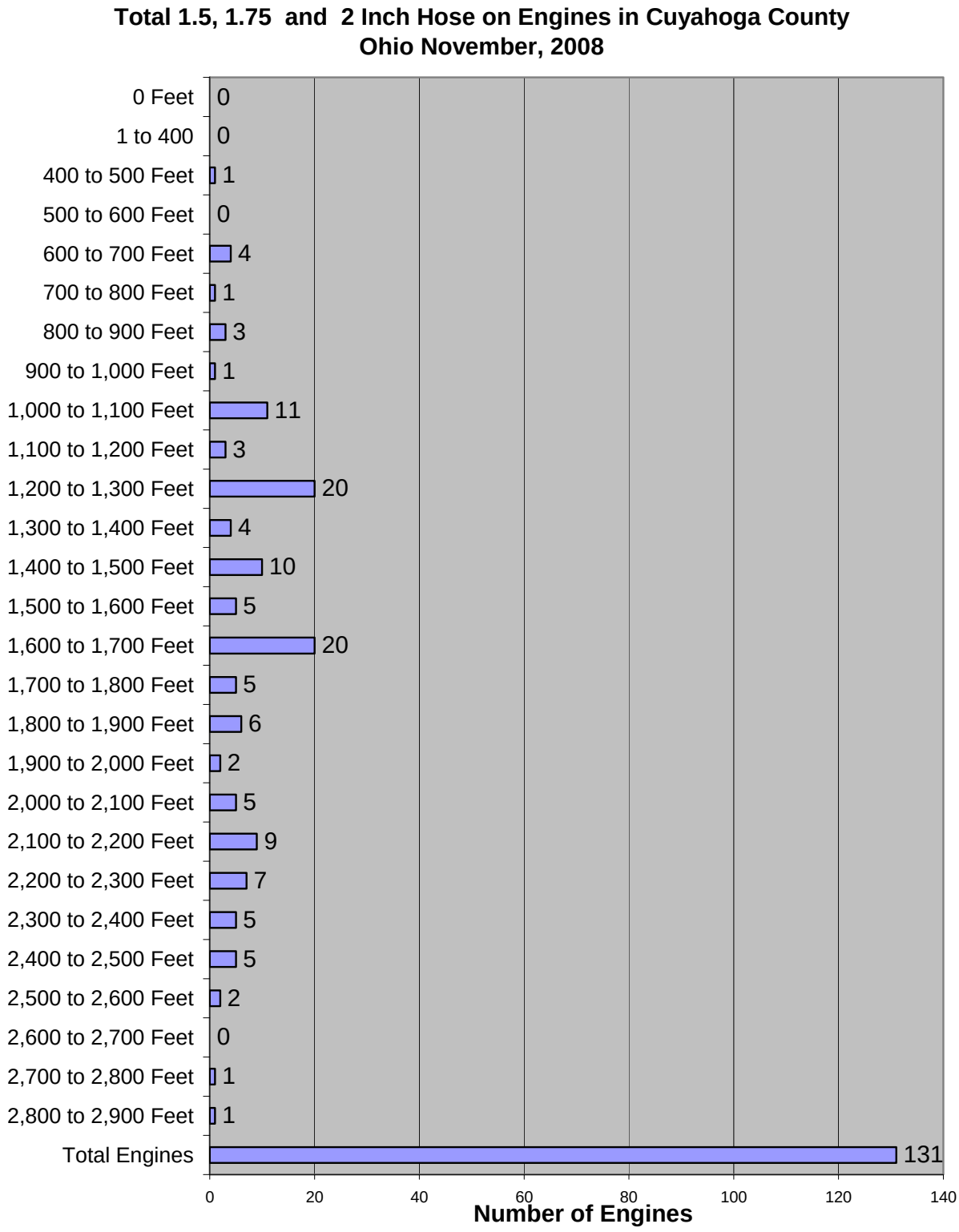

Total 1.5, 1.75 and 2 Inch Hose on Engines in Cuyahoga County Ohio November, 2008
0 Feet 0
1 to 400 0
400 to 500 Feet 1
500 to 600 Feet 0
600 to 700 Feet 4
700 to 800 Feet 1
800 to 900 Feet 3
900 to 1,000 Feet 1
1,000 to 1,100 Feet 11
1,100 to 1,200 Feet 3
1,200 to 1,300 Feet 20
1,300 to 1,400 Feet 4
1,400 to 1,500 Feet 10
1,500 to 1,600 Feet 5
1,600 to 1,700 Feet 20
1,700 to 1,800 Feet 5
1,800 to 1,900 Feet 6
1,900 to 2,000 Feet 2
2,000 to 2,100 Feet 5
2,100 to 2,200 Feet 9
2,200 to 2,300 Feet 7
2,300 to 2,400 Feet 5
2,400 to 2,500 Feet 5
2,500 to 2,600 Feet 2
2,600 to 2,700 Feet 0
2,700 to 2,800 Feet 1
2,800 to 2,900 Feet 1
Total Engines 131
0 20 40 60 80 100 120 140
Number of Engines

Figure 4

Hose: 2.5 Inch and 3 Inch

Figure 5 demonstrates the fire service's commitment to an old favorite, the 2.5 inch hose. This hose was found on 113 of the 131 engines. The 2.5 inch hose ranked second in overall usage to the 1.75 inch hose. The majority of departments were found to carry between 200 and 700 feet of 2.5 inch hose. The 3 inch hose, on the other hand, proved to be far less popular. Approximately one-half (65) of the engines were found to carry 3 inch hose.

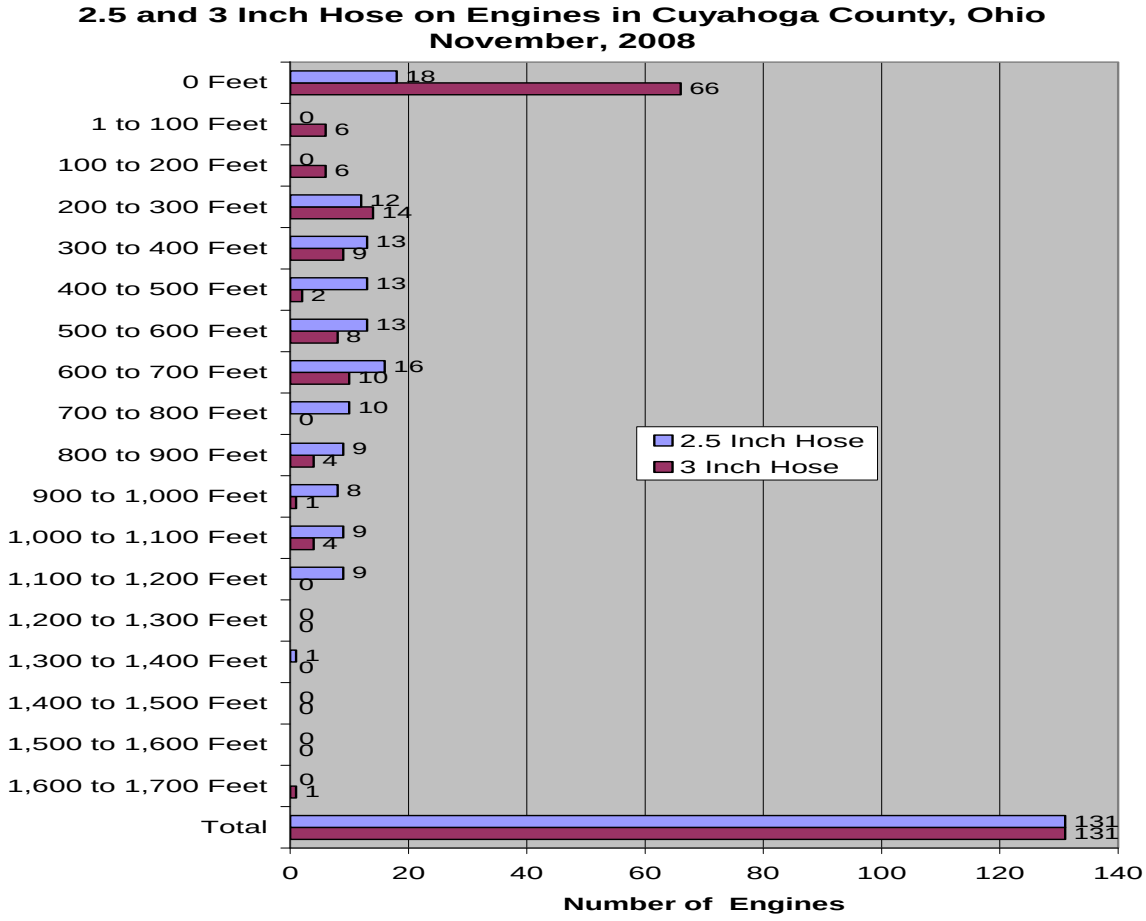


Figure 5

Hose: 4 Inch and 5 Inch

The use of 4 inch and 5 inch Large Diameter Hose (LDH) is currently in use on 128 of the 131 engines within the county. The use of 4 inch hose outnumbers the use of 5 inch by a 2 to 1 ratio. All of the 5 inch hose has Storz couplings. However, the 4 inch hose is divided between Cleveland Standard threaded couplings and Storz couplings. The use of Cleveland Standard threaded couplings outnumbers the Storz couplings 51 to 32 as depicted in Figure 6a. Engines with the largest amounts of LDH, over 1,600 feet, utilize 5 inch hose (Figure 6b). Total hose loads for hose over 2.5 inch are illustrated in Figure 6c.

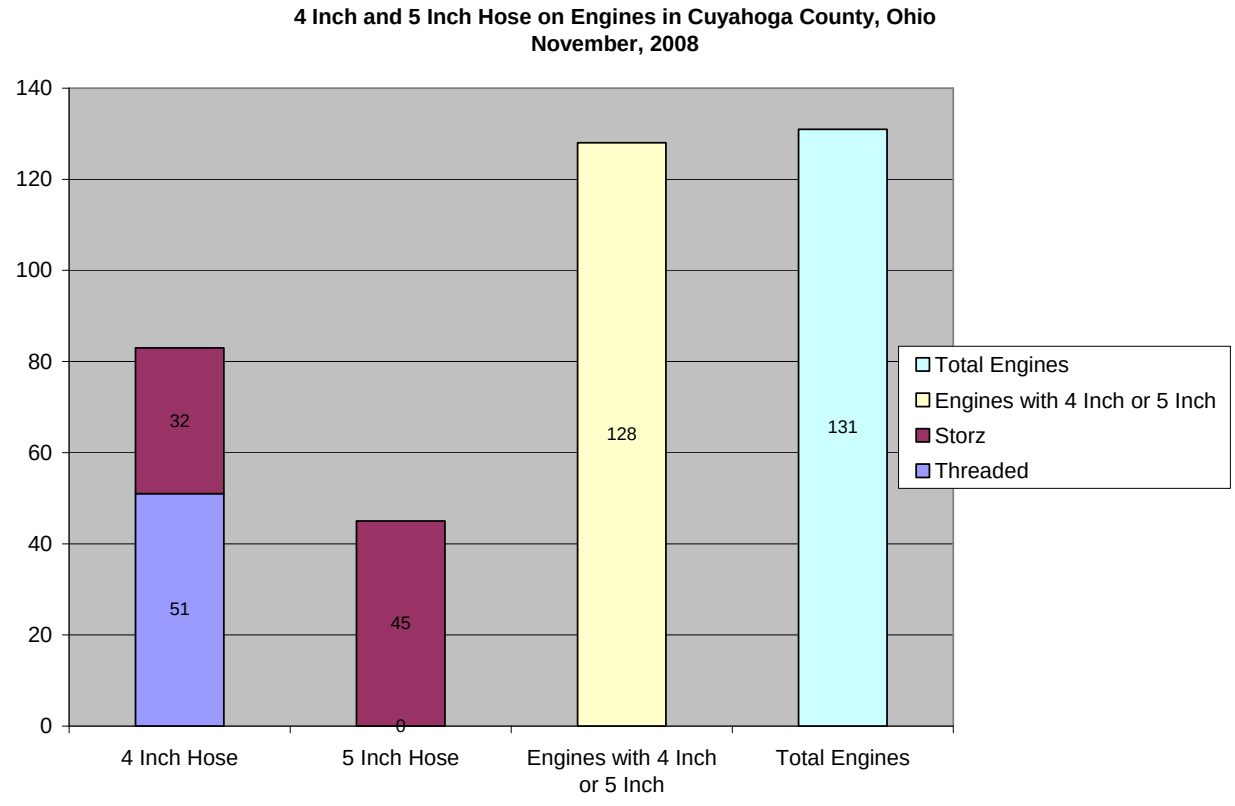
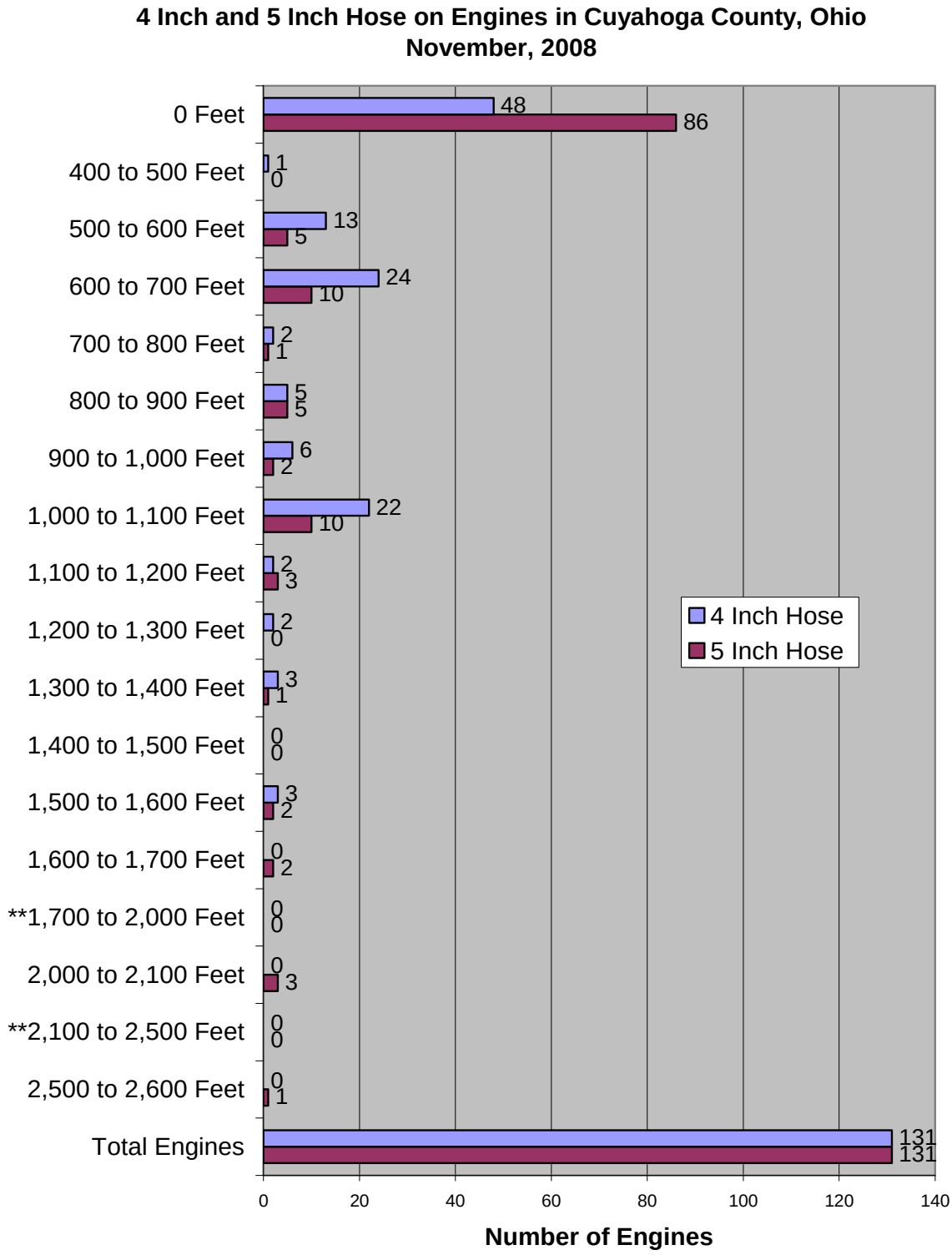


Figure 6a



** Break in series

Figure 6b

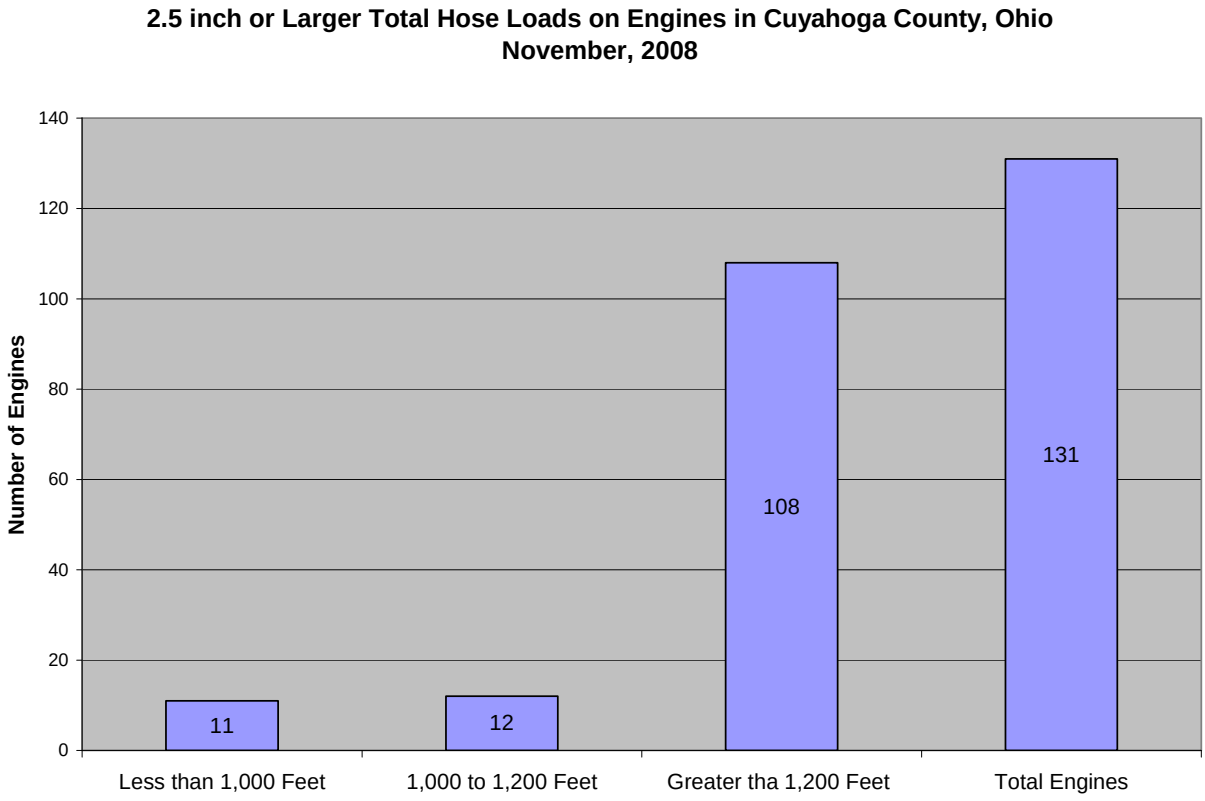


Figure 6c

Hose: 4 Inch and 6 Inch Hard Suction

Approximately 84% of all engines within the county carry no hard suction hose. The 6 inch appears to be the size of choice in that 20 of the 22 engines that carried hard suction hose carried 6 inch (see Figure 7). Only one engine was found to carry both 4 inch and 6 inch. The most common configuration of those that carried hard suction was two, ten foot lengths.

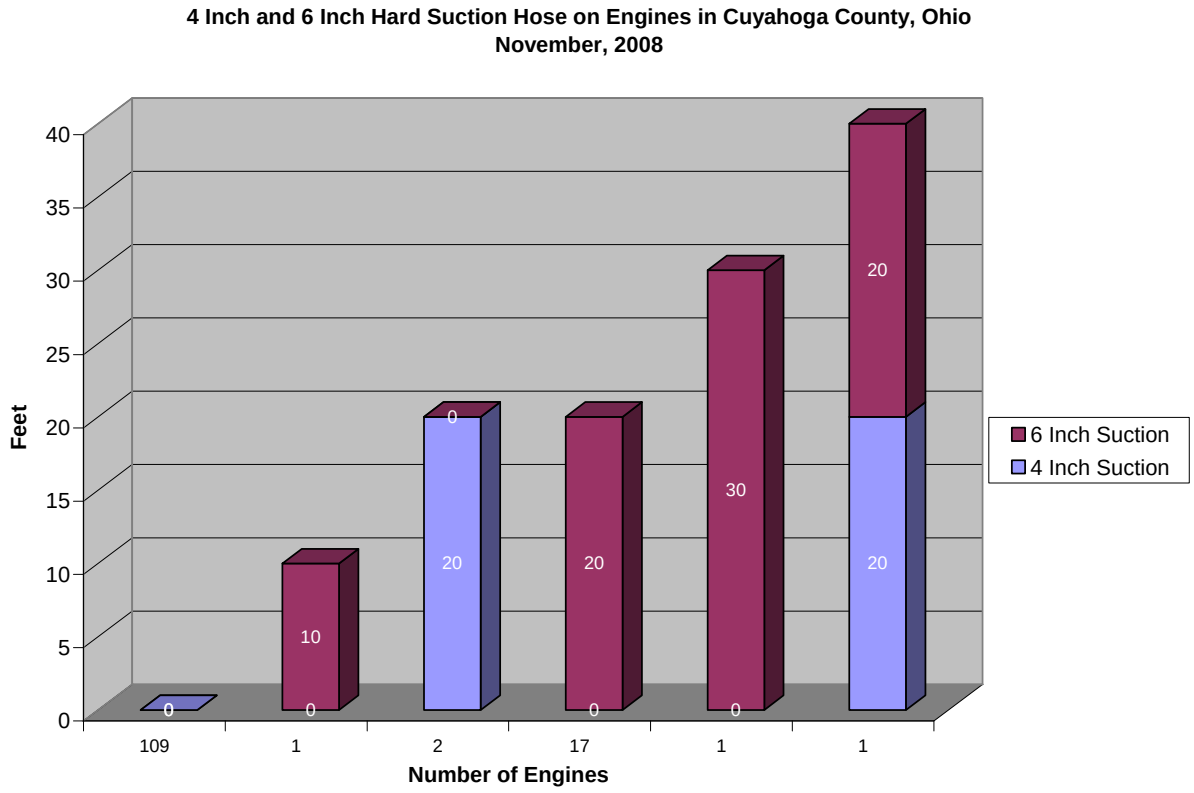


Figure 7

Monitors/Master Streams Appliances

Only five engines did not have any type of monitor/master stream appliance. As illustrated in Figure 8, the combination monitor (monitor/master stream appliance which is fixed and prepiped that can be removed and attached to a portable base that is stored on the engine) was present on 90 engines within the county. Fixed monitors were found on 26 engines. This includes the 12 quints or squirts with fixed elevated devices. Three units had multiple devices. Portable devices were present on seven engines.

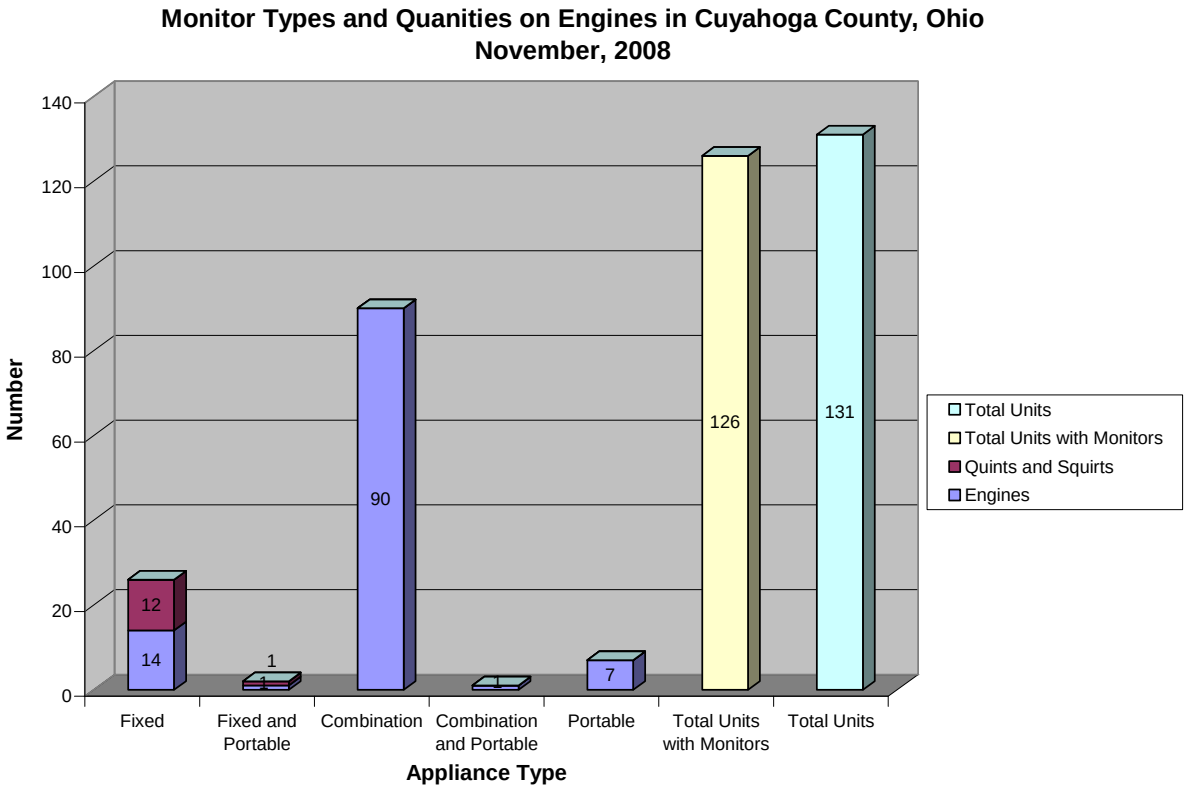


Figure 8

Typing of the Cuyahoga County Engines

Based upon the pump capacities and required fire hose, 31 of the 131 engines would meet the minimum requirements and qualify as Type I engines. Three of the 31 engines would also qualify as Type II engines. The remaining 100 engines would not qualify for any typing classifications (Figure 9).

The minimum 1,200 foot of 2.5 inch hose for Type I would have eliminated 23 engines from this category. The 1,000 foot of 2.5 inch for Type II would have reduced the number to 11.

The 1.5 inch requirement would have eliminated one engine from the Type II requirement of 500 feet.

By far the most restrictive factor proved to be the 1 inch hose requirement of 200 feet.

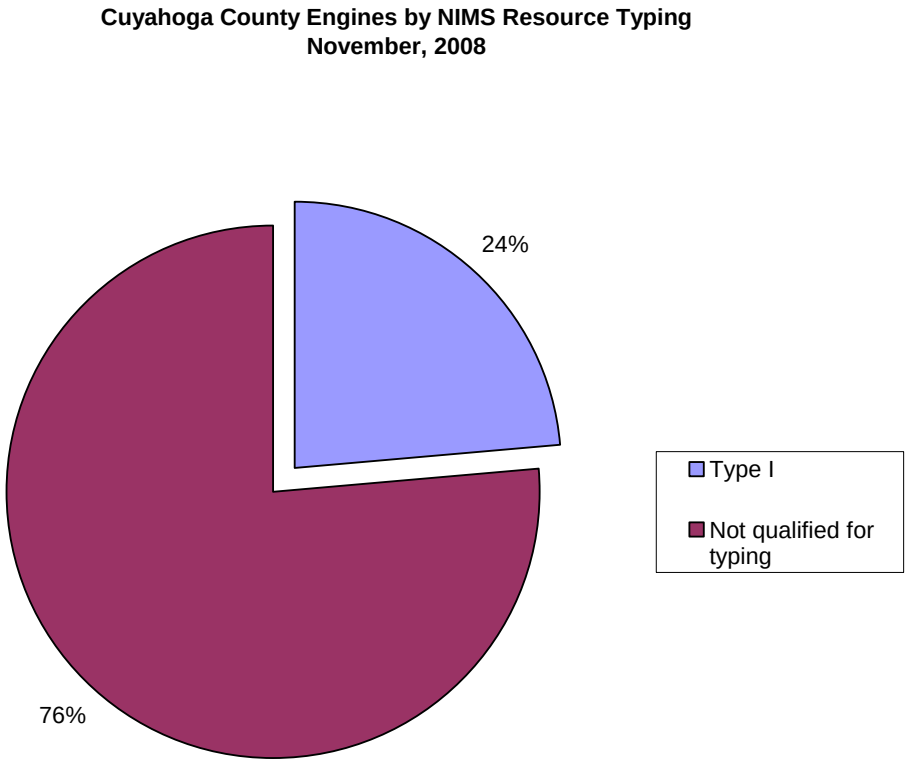


Figure 9

Engine Attributes at Major Incidents

Incident commanders at major events were almost evenly split on their preferred preference pump capacity. As illustrated in Figure 10, 16 Incident commanders wanted at least 1,250 gpm engines while the remaining 15 desired 1,500 gpm engines.

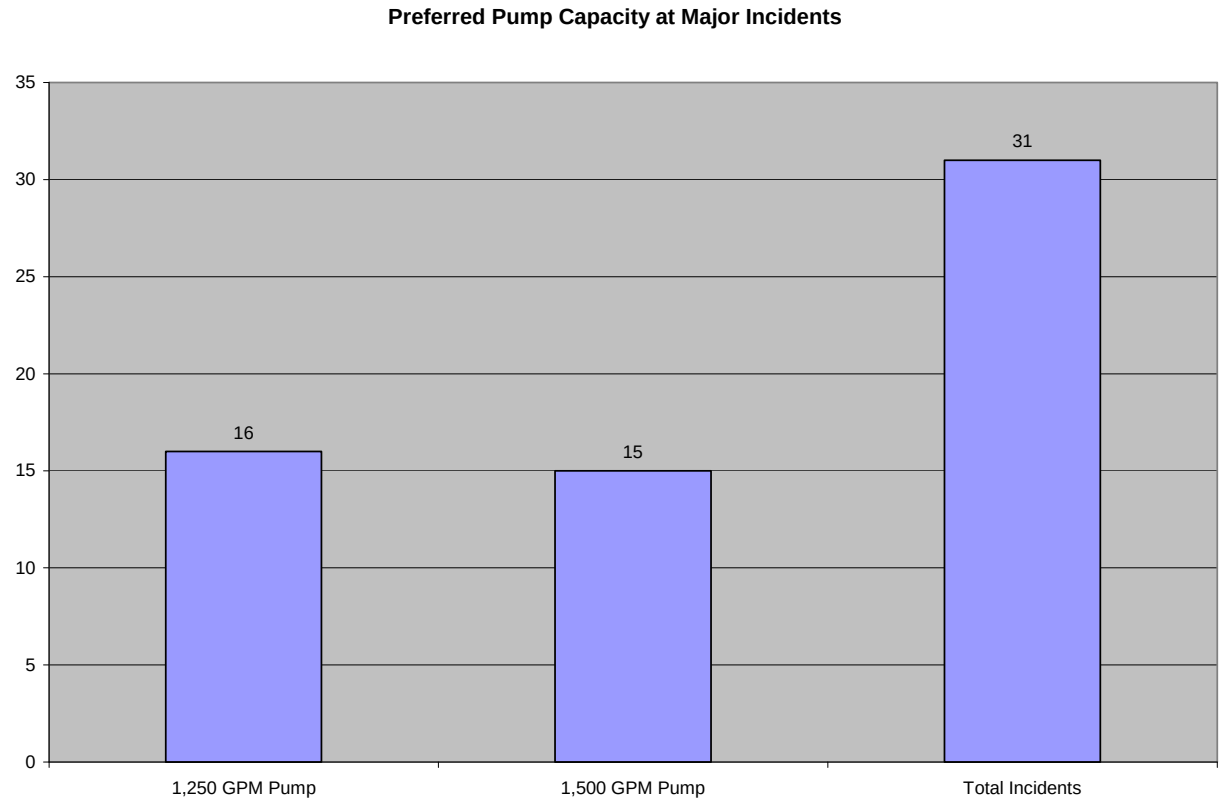


Figure 10

The results from the fire hose portion of the Engine Attributes at Significant Events questionnaire (Figure 11) reveal 1 inch fire hose was not a factor in any of the 31 incidents. The fire hose that received the highest significance rating was the 1.75 inch hose. The 2.5 inch hose was ranked second followed by 3 inch hose.

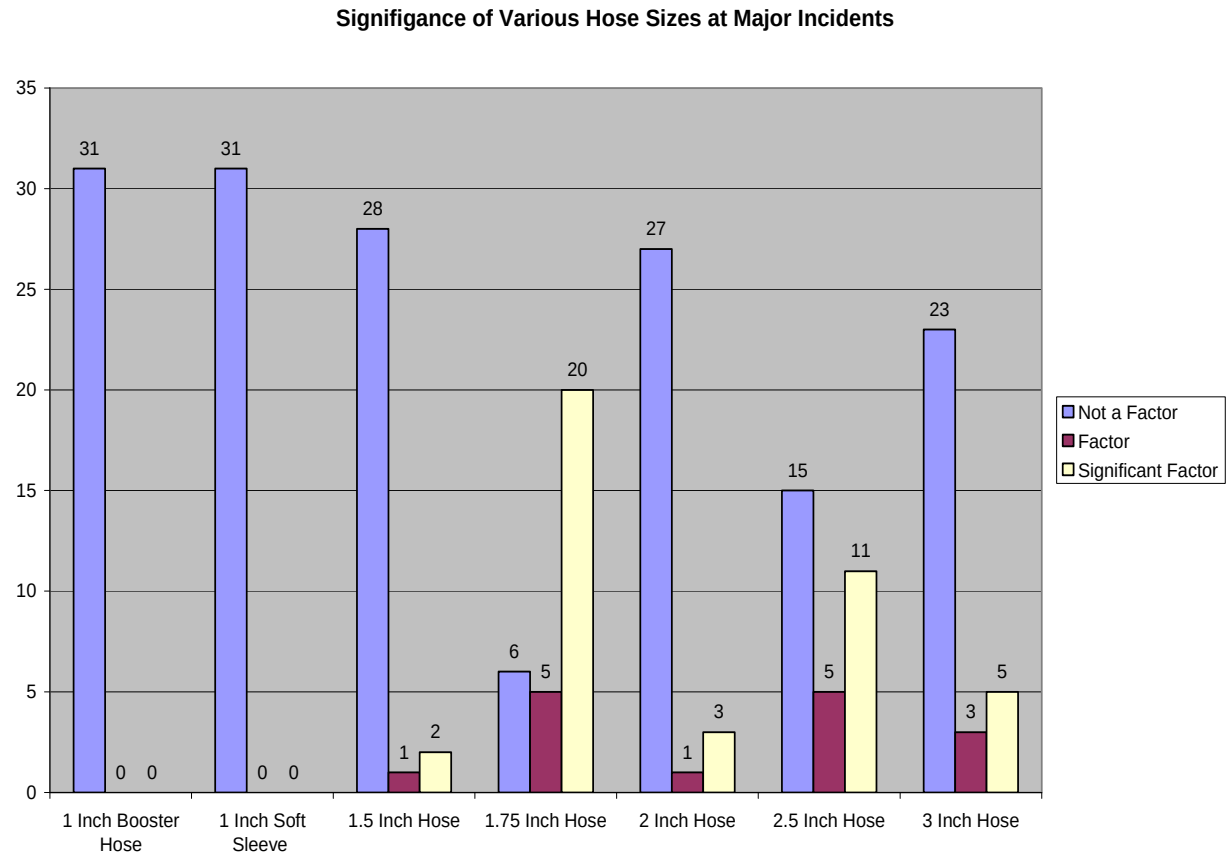


Figure 11

The 4 inch or 5 inch hose was found to be a factor in all but one event. The 4 inch proved to be the preferred choice by the incident commanders. The option of 4 inch or 5 inch far outnumbered the 5 inch hose option. Five inch hose only received 2 significant factor ratings (Figure 12).

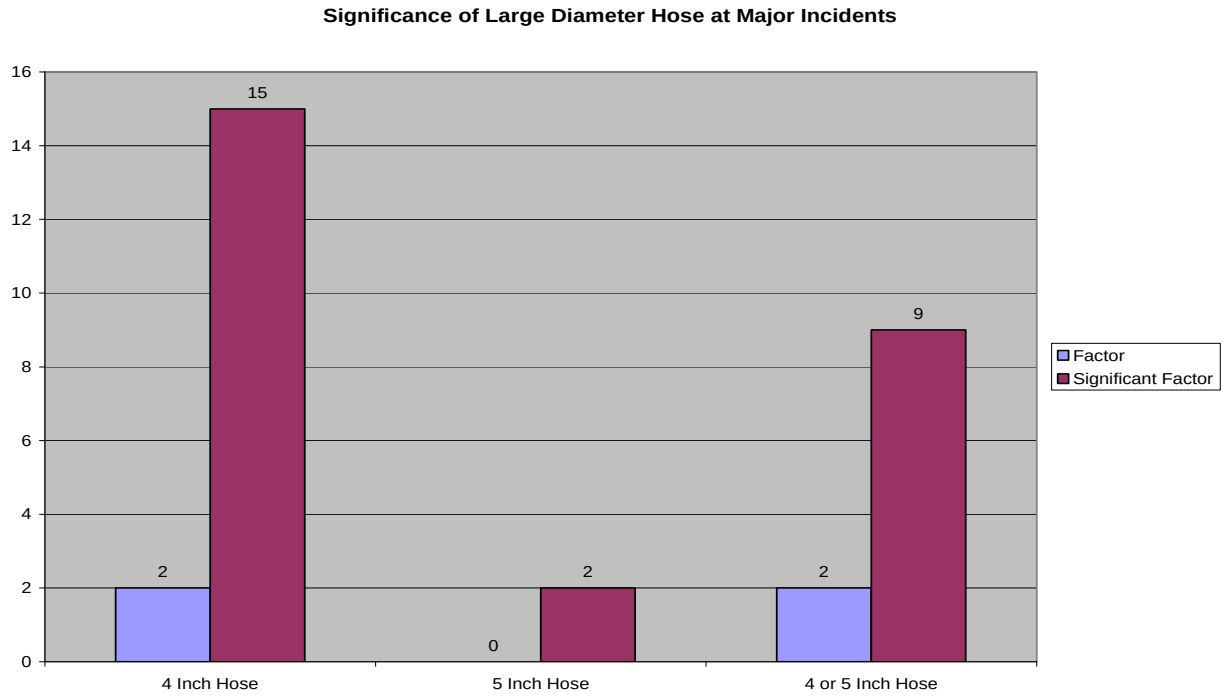


Figure 12

Other engine attributes rated were hard suction hose, portable monitors, fixed monitors and foam. As illustrated in Figure 13a hard suction hose was not a factor in any of the 31 incidents. The portable monitor proved to be the most valuable asset in this category. The portable monitor proved to be a factor in two events and played a significant factor in four events. The fixed monitor closely followed the portable monitor in that it received three significant factor ratings. Foam only proved to be a factor in one event. Figure 13b assesses the same equipment at larger scale events where five or more mutual aid engines were present.

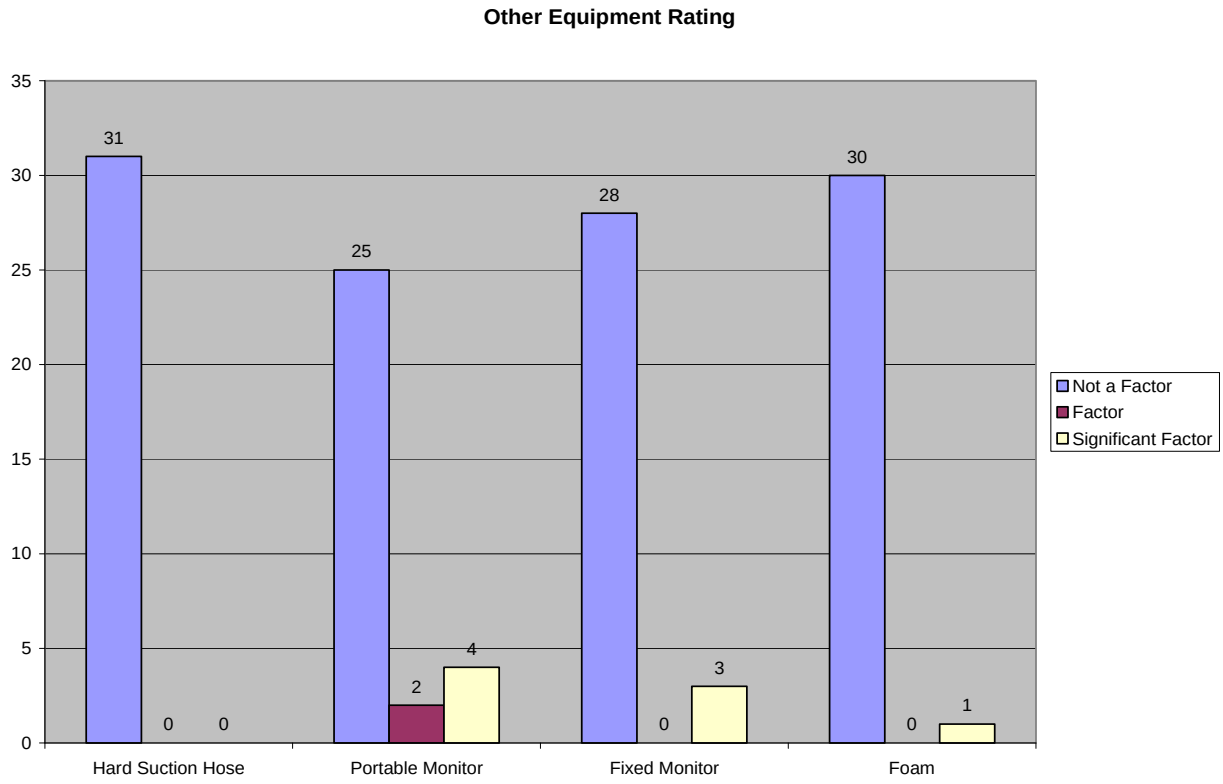


Figure 13a

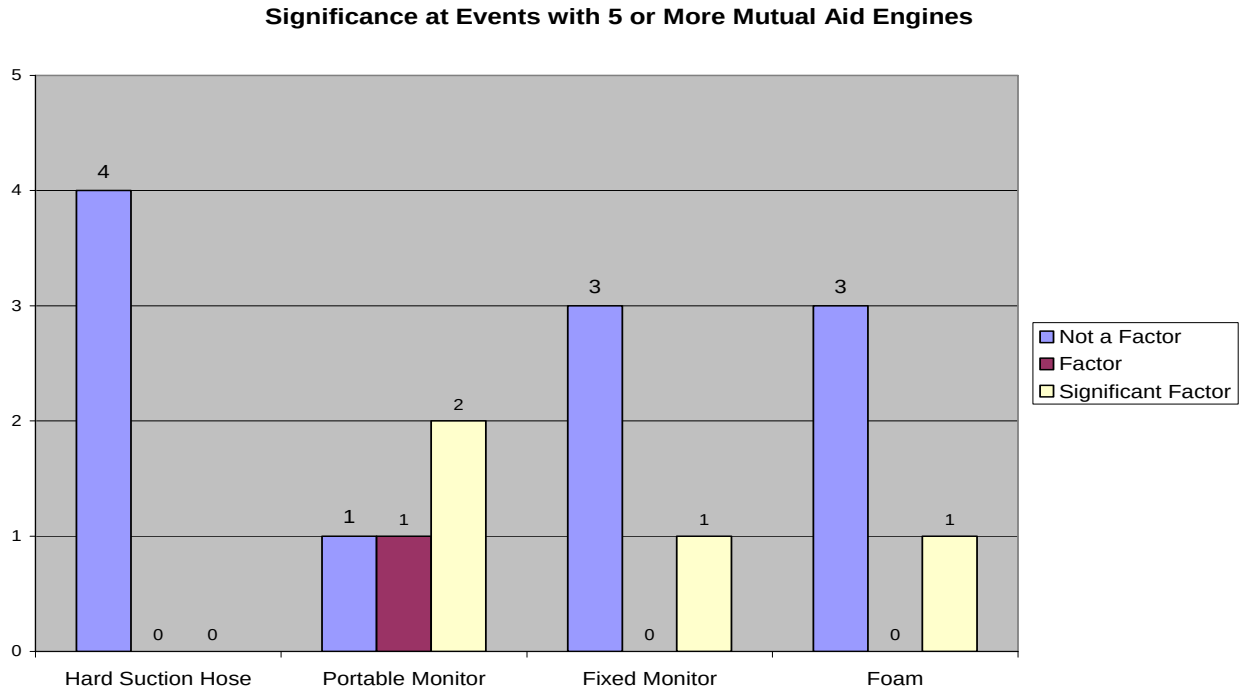


Figure 13b

Mutual Aid Engine Responses

For the most part, the engines in Cuyahoga County respond to the same types of mutual aid and with the same frequencies as that of the rest of the State of Ohio. Figures 14 through 16 list the top 20 types of incidents that mutual aid engines responded to in the State of Ohio. The Cuyahoga County incidents were removed and calculated separately. Most categories were found to be within 2% of each other on a consistent basis. The categories that exceeded the 2% are building fires, cancellations en route and cover assignments (move-up). Cuyahoga County has a slightly higher response percentage to building incidents annually. However, lower percentages are consistently found in the cancellations en route and cover assignments (move-up) type requests for Cuyahoga County.

2007 Mutual Aid Engine Responses: State of Ohio Compared to Cuyahoga County

Type Incident	Responses within the State of Ohio Excluding Cuyahoga County	Responses within Cuyahoga County	Description	Percentage of Remainder of the State of Ohio	Percentage of Total Cuyahoga County
111	2545	230	Building fire	35%	49%
611	1984	70	Dispatched & cancelled en route	27%	15%
571	495	11	Cover assignment, standby, moveup	7%	2%
651	171	13	Smoke scare, odor of smoke	2%	3%
131	123	16	Passenger vehicle fire	2%	3%
112	63	0	Fires in structure other than in a building	1%	0%
113	64	11	Cooking fire, confined to container	1%	2%
114	94	2	Chimney or flue fire, confined to chimney or flue	1%	0%
121	39	1	Fire in mobile home used as fixed residence	1%	0%
132	42	3	Road freight or transport vehicle fire	1%	1%
142	83	3	Brush or brush-and-grass mixture fire	1%	1%
143	40	0	Grass fire	1%	0%
151	52	2	Outside rubbish, trash or waste fire	1%	0%
311	46	4	Medical assist, assist EMS crew	1%	1%
321	76	2	EMS call, excluding vehicle accident with injury	1%	0%
322	106	10	Motor vehicle accident with injuries	1%	2%
412	97	4	Gas leak (natural gas or LPG)	1%	1%
440	45	0	Electrical wiring/equipment problem, Other	1%	0%
551	67	1	Assist police or other governmental agency	1%	0%
622	53	0	No Incident found on arrival at dispatch address	1%	0%

Figure 14

Total mutual aid engine responses for State of Ohio: 7,836

State of Ohio without Cuyahoga County: 7,366. Cuyahoga County total responses: 470

2006 Mutual Aid Engine Responses: State of Ohio Compared to Cuyahoga County

Type	Responses within the State of Ohio Excluding Cuyahoga County	Responses within Cuyahoga County	Description	Percentage of Remainder of the State of Ohio Mutual Aid Engine Responses	Percentage of Total Cuyahoga County Mutual Aid Engine Responses
111	2229	160	Building fire	34%	46%
611	1721	61	Dispatched & cancelled en route	26%	18%
571	488	1	Cover assignment, standby, moveup	7%	0%
651	125	9	Smoke scare, odor of smoke	2%	3%
700	125	4	False alarm or false call, Other	2%	1%
142	117	4	Brush or brush-and-grass mixture fire	2%	1%
322	102	5	Motor vehicle accident with injuries	2%	1%
131	93	10	Passenger vehicle fire	1%	3%
114	86	2	Chimney or flue fire, confined to chimney or flue	1%	1%
113	70	12	Cooking fire, confined to container	1%	3%
745	66	3	Alarm system activation, no fire - unintentional	1%	1%
735	65	4	Alarm system sounded due to malfunction	1%	1%
151	64	2	Outside rubbish, trash or waste fire	1%	1%
600	61	9	Good intent call, Other	1%	3%
412	57	1	Gas leak (natural gas or LPG)	1%	0%
112	46	2	Fires in structure other than in a building	1%	1%
143	44	1	Grass fire	1%	0%
531	40	3	Smoke or odor removal	1%	1%
730	39	2	System malfunction, Other	1%	1%
561	38	0	Unauthorized burning	1%	0%

Figure 15

Total mutual aid engine responses for State of Ohio: 6,863

State of Ohio without Cuyahoga County: 6,517. Cuyahoga County total responses: 346

2005 Mutual Aid Engine Responses: State of Ohio Compared to Cuyahoga County

Type Incident	Responses within the State of Ohio Excluding Cuyahoga County	Responses within Cuyahoga County	Description	Percentage - Remainder of the State of Ohio	Percentage of Total Cuyahoga County
111	2201	170	Building fire	35%	53%
611	1438	37	Dispatched & cancelled en route	23%	11%
571	432	3	Cover assignment, standby, moveup	7%	1%
700	154	0	False alarm or false call, Other	2%	0%
131	140	9	Passenger vehicle fire	2%	3%
322	121	5	Motor vehicle accident with injuries	2%	2%
600	96	1	Good intent call, Other	2%	0%
114	94	0	Chimney or flue fire, confined to chimney or flue	2%	0%
142	91	4	Brush or brush-and-grass mixture fire	1%	1%
651	90	3	Smoke scare, odor of smoke	1%	1%
412	84	2	Gas leak (natural gas or LPG)	1%	1%
735	75	2	Alarm system sounded due to malfunction	1%	1%
151	56	2	Outside rubbish, trash or waste fire	1%	1%
143	55	1	Grass fire	1%	0%
112	54	3	Fires in structure other than in a building	1%	1%
745	51	4	Alarm system activation, no fire - unintentional	1%	1%
113	49	13	Cooking fire, confined to container	1%	4%
121	34	0	Fire in mobile home used as fixed residence	1%	0%
150	34	2	Outside rubbish fire, Other	1%	1%
531	33	2	Smoke or odor removal	1%	1%

Figure 16

Total mutual aid engine responses for State of Ohio: 6,549

State of Ohio without Cuyahoga County: 6,227. Cuyahoga County total responses: 322

Discussion

The vast majority of engines in Cuyahoga County appear to be primarily configured for structural fire fighting operations. The overwhelming use of the 1.75 inch hand lines, the use of LDH and an average pump size of 1,500 gpm suggest a high emphasis is placed upon achieving high flow rates.

The current configurations of the engines in Cuyahoga County indicate only 24% of the 131 total engines would qualify under any present FEMA typing requirement. These results differ greatly from the results of Coulombe (2006). Coulombe's (2006) results for the engine typing revealed 48 Type I engines were available from the 14 responses received. This equated to an average of 3 Type I engines per community.

By far, the most restrictive factor eliminating engines from being "Typed" was the 1 inch hose requirement. This requirement alone eliminated 100 of the 131 engines. Unfortunately, with a minimum set on one inch hose and a minimum set on 1.5 inch hose, there is no other hose size in-between the two. It must be 1 inch hose. Although ISO (2008b) requires 200 feet of booster hose, their equivalencies now allow for the use of 1.5 inch or 1.75 inch hose, provided the hose is preconnected. No documentation

was found to support the necessity of 1 inch hose on a Type I or Type II engine. It remains unclear as to how 200 feet of 1 inch hose outperforms 200 feet of 1.5 or 1.75 inch hose enough to warrant a required status on Type I or Type II engines.

As previously stated, both the NIMS documentation and Kyle Blackman, Chief of Resource Planning and Coordination Branch, NIC, would like everyone to start utilizing the NIMS typing terminology so that when an emergency arises there is no confusion as to what to call the resource. However, with 74% of a county's resources not qualifying as a resource, the terminology will be slow to catch on, at least in that county.

Unfortunately, no data was collected regarding booster tank size. In retrospect, the decision to abandon the data collection on this attribute was made prematurely. This project would have been better served by collecting the data from the known engine booster tank sizes and providing an unknown option. This would at least have provided some insight on this aspect.

What was found to be most interesting was the lack of a master stream appliance. The current ISO (2008b), FIRESCOPE (2007) and the previous NWCG (1998) documents all had a master stream requirement.

Perhaps one of the most confusing aspects of the research project was trying to determine the role of the engine itself as it relates to the teachings of ICS-100 and ICS-200. If Type I is supposed to be the biggest and most capable, and the primary role of an engine is to move water, then why are the requirements so minimal for a Type I engine? The maximum pump required is only 1,000 gpm when engines are now being produced at 2,000 gpm. The maximum hose size required is only 2.5 inch when hose is now available in 4 and 5 inch sizes.

The document which appeared to be most applicable to an urban disaster such as Katrina, or an earthquake, was *Equipping Fire Apparatus for Use in the Wildland Interface* by NWCG (1998). This document designated Type I and Type II as structural and the remaining types as wildland. In addition, provisions were made for master streams on Type I engines along with ladder requirements for both Type I and Type II. Most notably was the absence of the 1 inch hose requirement.

Several unexpected results were discovered as a result of this research. The first unexpected result was the lack of significance of the 5 inch hose. The 4 inch hose was chosen more frequently as a factor, or significant factor, over the 5 inch hose. Even the option of 4 or 5 inch hose

had a higher value than the 5 inch alone. In addition, in the three events requiring the largest water movement 5 inch hose was not perceived as a significant factor over the 4 inch supply line. For those of us who deploy 5 inch hose, this ultimately leads to the question of whether or not the extra flow capability is worth the added weight/work load it places on our firefighters.

Another unexpected finding was the amount of the threaded 4 inch hose utilized within the county. Storz couplings had been pretty much the standard. However, it appears that the inner core cities within the county (Cleveland, Parma etc.) have migrated to the threaded couplings. The perimeter communities, those faced with thread compatibility issues with Cleveland Standard threads and adjacent county thread types, have maintained their Storz couplings for interoperability. As a result, a set of 5 inch Storz to 4 inch Cleveland Standard threaded couplings have been ordered for one engine in our own department. The second engine now awaits a decision on whether to maintain 5 inch hose or switch to 4 inch supply line.

Perhaps the most unexpected result was the comparison between Cuyahoga County and the rest of the State of Ohio on the mutual aid responses. With Cuyahoga County being the most populated county, a higher level of responses were

expected in the wildland/grass/forest categories for the remainder of the state. Outside of the three big ‘C’s” (Cleveland, Columbus, Cincinnati), Ohio still contains a lot of rural areas.

Recommendations

First and foremost, a considerable amount of research still needs to be conducted to establish a sound set of metrics based upon tactical objectives for Type I and Type II engines. The information contained herein is limited to one county within a country.

Secondly, extensive research and interviews should be conducted on the largest mutual aid incident for each state over a three year period. This report focused on events within Cuyahoga County, Ohio, where three or more mutual aid engines responded. As seen in Appendix O, the larger the event the larger the water flow requirements.

Finally, if a recommendation was to be made based upon the limited information obtained thus far, it would be to follow the NWCG model. Type I and Type II engines would be clearly delineated as structural engines with the remaining categories dedicated to wildland operations. Type I engines would be given tactical objectives of water supply and defensive operations. Type II engines would be assigned structural offensive objectives.

Based upon the offensive structural objective the metrics would closely follow the NFPA 1901 Standards for pump size, booster tank size and hose compliment. In addition, the NFPA ladder requirement would be included as a requirement. Whereas, the tactical assignment is offensive structural operations, the personnel requirement would be increased from three to four.

The Type I engine with the primary tactical objectives of water supply and defensive operations would have significantly higher requirements. The minimum pump capacity would be increased from 1,000 gpm to 1,500 gpm. The current minimum 1,200 feet of 2.5 inch hose supply would be increased to a minimum of 1,200 feet of 3 inch (for a double lay) or 600 feet of 4 inch hose or greater. A minimum requirement of 20 feet of 4 inch or larger hard suction would be added to provide for drafting operations. This need was well documented with Katrina and would be most beneficial for any operations with a limited or interrupted water supply. To achieve the defensive tactical objective, the Type I engine would require a portable master stream device capable of 500 gpm or greater. The portability requirement provides the most flexibility for setting up defensive operations.

The 1.5 inch hose requirements would remain as currently presented, 400 feet for type I and 500 feet for Type II.

The 1 inch hose requirement would be eliminated from both Type I and Type II requirements.

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Appendix A

Cuyahoga Community Name by Cuyahoga County Region

Chagrin Region:

- Hunting Valley
- Orange
- Chagrin Falls Township
- Bentleyville
- Woodmere
- Moreland Hill
- Chagrin Falls

Cleveland Region:

- Cleveland
- Bratenahl
- Linndale

Cuyahoga Valley Region:

- Newburgh Heights
- Brooklyn Heights
- Independence
- Broadview Heights
- Cuyahoga Heights
- Seven Hills
- Valley View
- Brecksville

Heights Region:

- East Cleveland
- University Heights
- Cleveland Heights
- Shaker Heights

Hillcrest Region:

- Euclid
- Highland Heights
- South Euclid
- Mayfield Heights
- Beachwood
- Richmond Heights
- Mayfield Village
- Lyndhurst
- Gates Mills
- Pepper Pike

Southcentral Region:

- Brooklyn
- Parma Heights
- Parma
- North Royalton

Southeast Region:

- Garfield Heights
- Highland Hills
- Warrensville Heights
- Bedford
- Oakwood
- Solon
- Maple Heights
- North Randall
- Bedford Heights
- Walton Hills
- Glenwillow

Southwest Region:

- Olmsted Township
- Brookpark
- Middleburg Heights
- Olmsted Falls
- Berea
- Strongsville

Westshore Region:

Bay Village	Westlake
North Olmsted	Lakewood
Rocky River	Fairview Park

Note: Source - Cuyahoga County Division of Emergency Services

August, 2008

Appendix B

FEMA 508-4 Engine Typing Definition

U.S. Department of Homeland Security
Federal Emergency Management Agency

RESOURCE:		Engine, Fire (Pumper)				
CATEGORY:	Firefighting (ESF #4)			KIND:	Equipment	
MINIMUM CAPABILITIES:		TYPE I	TYPE II	TYPE III	TYPE IV	OTHER
COMPONENT	METRIC					
Equipment	Pump Capacity	1,000 GPM	500 GPM	120 GPM	70 GPM	50 GPM
Equipment	Tank Capacity	400 Gal.	400 Gal.	500 Gal.	750 Gal.	500 Gal.
Equipment	Hose, 2.5 inch	1,200 ft.	1,000 ft.			
Equipment	Hose, 1.5 inch	400 ft.	500 ft.	1,000 ft.	300 ft.	300 ft.
Equipment	Hose, 1 inch	200 ft.	300 ft.	800 ft.	300 ft.	300 ft.
Personnel	Personnel	4	3	3	2	2
COMMENTS:	The engine typing needs to be taken out to Type VII. Compromise between FIRESCOPE and NWCG is to use NWCG Standards for Engines and Crews. NWCG has seven engine types.					

Source: Typed Resource Definitions: Fire and Hazardous Materials
FEMA 508-4, July, 2005 (P.7)

Appendix C
ISO Engine Requirements and Equivalencies

FSRS Equipment Equivalencies

Pumper Equipment (Table 512.A)

Item	Needed	Equivalencies
Booster tank	300 gallons	300 gallons or larger
Booster hose	200 feet	1-1/2" or 1-3/4" preconnected hose
1-1/2" hose	400 feet	1-3/4" or 2" hose
2-1/2" or larger hose	1,200 feet	The first 400 feet can be 2", 2-1/2" or 3"; the remaining 800 feet must be 2-1/2" or larger hose.
Heavy-stream appliance (1,000 gpm)	1	Not needed when the Basic Fire Flow is less than 1,500 gpm. A portable attack monitor or a mounted, elevated, or portable appliance is acceptable. Prorations are made in 250-gpm increments.
Distributing nozzle (1-1/2" min.)	1	• 1-1/2" or 2-1/2" piercing nozzle • 1-1/2" or 2-1/2" distributing nozzle, cellar nozzle
Foam nozzle (1-1/2" min.)	1	• 1-1/2" or 2-1/2" eductor • Built-in proportioning system • CAFS
Foam	25 gallons, of which 10 gallons is carried on the pumper	• Any foam listed in the "UL Fire Protection Equipment Directory" as foam liquid concentrate (GFGV) • Class A foam Wetting agents, emulsifiers, and surfactants are *not* acceptable for credit as foam.
2-1/2" playpipe with shutoff	2	Portable attack monitor with solid-bore tip
2-1/2" straight stream & spray with shutoff	2	• 200 gpm nozzles • 1-3/4" combination vari-nozzle tip nozzles with a 2-1/2" adapter • Portable attack monitor with fog tip
1-1/2" straight stream & spray with shutoff	2	1-3/4" combination nozzle with 1-1/2" coupling
Breathing equipment (30-minute minimum)	4	4 @ 30-minute or longer duration
Spare SCBA cylinders (SCBA)(30-minute minimum)	4	4 @ 30-minute or longer duration Portable air cascade or air filling station is *not* equivalent.
Salvage covers (12-ft. x 18-ft.)	2	12-ft. x 14-ft. canvas or rip-stop plastic
Handlight (4v wet, 6v dry)	2	Rechargeable 6v handlight
Hose clamp	1	2-1/2", 3", or LDH hose clamp
Hydrant hose gate (2-1/2")	1	4-way valve, LDH manifold, trimese
Burst hose jacket (2-1/2")	1	2-1/2", 3", or LDH hose clamp
Gated wye 2-1/2" x 1-1/2" x 1-1/2"	1	Water thief, 2-1/2" gated wye with 1-1/2" reducers
12- or 14-ft. roof ladder	1	16-ft. roof ladder
24-ft. extension ladder	1	28-, 30-, or 35-ft. extension ladder

Source: Insurance Services Office
Presurvey Information Request for Fire Department Features for Fire Suppression

Appendix D
FIRESCOPE Resource Definitions

PRIMARY MOBILE SUPPRESSION RESOURCES
(Minimum ICS Standards)

RESOURCE	RADIO CALL	COMPONENTS	TYPES			
			1	2	3	4
Engine Company	Engine Telesquirt*	Pump Water Tank Hose 2 1/2" Hose 1 1/2" Hose 1" Ladder Master Stream Personnel	1,000 GPM 400 Gal. 1,200 Ft. 400 Ft. 200 Ft. 20 Ft. Ext. 500 GPM 4	500 GPM 400 Gal. 1,000 Ft. 500 Ft. 300 Ft. 20 Ft. Ext. - 3	120 GPM 300 Gal. - 1,000 Ft. 800 Ft. - - 3	50 GPM 200 Gal. - 300 Ft. 800 Ft. - - 3
* Engine with elevated stream capability, specify when requested.						
Truck Company	Truck	Aerial (Specify platform or ladder), Elevated Stream, Ground Ladders, Personnel	75 Ft. 500 GPM 115 Ft. 4	50 Ft. 500 GPM 115 Ft. 4		
Water Tender	Water Tender	Pump Water Tank	300 GPM 2,000 Gal.	120 GPM 1,000 Gal.	50 GPM 1,000 Gal.	
Brush Patrol	Patrol	Pump-15 GPM Hose 1"-150 Ft. Tank -75 Gal. Personnel - 1				

Source: FIRESCOPE, *ICS Resources Listing: ICS 020-1*

Appendix E

State of Alaska Wildland Engine Types

Table 1. Wildland Engine Types

Type	T-3	T-4	T-5	T-6	T-7
Tank Cap Capacity (gals)	500 +	750 +	750 – 400	150 – 400	50 - 200
Pump Minimum Flow (gpm)	150	50	50	30	10
Pump Rated Pressure (psi)	250	100	100	100	100
Hose, 1-1/2" (feet)	500	300	300	300	--
Hose, 1" (feet)	500	300	300	300	200
Operator / Personnel minimum	2	2	2	2	2

Source: State of Alaska, *Supplemental Engine Requirements (2006)*

Appendix F

State of Colorado Engine Resource Typing

State of Colorado
Department of Public Safety
Resource Mobilization Working Group

RESOURCE: ENGINE, FIRE (PUMPER)								
Category:	Firefighting (SEF 4)				**Kind:**	Equipment		
Minimum Capabilities:		Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII
Component	**Metric**							
Pump Capacity		1,000 GPM	500 GPM	120 GPM	70 GPM	50 GPM	50 GPM	50 GPM
Tank Capacity		400 Gal.	400 Gal.	500 Gal.	750 Gal.	500 Gal.	200 Gal	125 Gal.
Hose, 2.5 inch		1,200 ft.	1,000 ft.	-	-	-	-	-
Hose, 1.5 inch		400 ft.	500 ft.	1,000 ft.	300 ft.	300 ft.	300 ft.	200 ft.
Hose, 1 inch		200 ft.	300 ft.	800 ft.	300 ft.	300 ft.	300 ft.	200 ft.
Personnel		4	3	3	2	2	2	2
Comments:	The engine typing needs to be taken out to Type VII. Compromise between FIRESCOPE and NWCG is to use NWCG Standards for Engines and Crews. NWCG has seven engine types.							

Source: *Fire/Hazmat Resource*, State of Colorado, Department of Public Safety (n.d.)

Appendix G

Northern Front Range Interagency Wildland Fire Cooperators

Engine Resource Typing

Minimum Standards for Type ("x" after type = all-wheel drive)

COMPONENT	1	2	3	4	5	6	7
Pump capacity (GPM)	1000	250+	150	50	50	30	10
Rated Pressure (PSI)	150	150	250	100	100	100	100
Tank capacity (gallons)	400+	400+	500+	750+	400-750	150-400	50-200
Hose, 2 ½" (feet)	1200	1000	-	-	-	-	-
Hose, 1 ½" (feet)	400	500	500	300	300	300	-
Hose, 1"	-	-	500	300	300	300	200
Ladder (feet)	48'	48'	-	-	-	-	-
Heavy stream (GPM)	500	-	-	-	-	-	-
Personnel**	4	3	2*	2*	2*	2*	2*

***Personnel includes 1 red-carded Engine Boss. The balance of personnel must be red-carded as FFT2.*

Based on Region Two Mobilization Guide, Chapter 70, Section 74 the regional standard for engines will be a minimum of three (3) personnel for all engine types and assignments.

Source: *Engine Dispatch Operators Guide,* Northern Front Range Interagency Wildland Fire Cooperators (2003, Appendix C)

Appendix H

National Wildfire Coordinating Group (NWCG) Engine Typing

Engine and Water Tender Resource Types

Minimum Requirements

Engine Types

Components	STRUCTURE ENGINES		WILDLAND ENGINES				
	1	2	3	4	5	6	7
Pump Rating							
minimum flow (gpm)	1000+	250+	150	50	50	30	10
at rated pressure (psi)	150	150	250	100	100	100	100
Tank Capacity Range (gal)	400+	400+	500+	750+	400-750	150-400	50-200
Hose (feet)							
2.1/2 inch	1200	1000	-	-	-	-	-
1.1/2 inch	400	500	500	300	300	300	-
1 inch	-	-	500	300	300	300	200
Ladders	48'	48'	-	-	-	-	-
Master Stream (GPM)	500	-	-	-	-	-	-
Personnel (minimum)	4	3	2	2	2	2	2

Common additional needs. Request as needed.
All wheel drive
Pump & Roll
High pressure pump (minimum 40 gpm @ 250 psi)
Class A Foam Proportioner
Compressed air foam system (CAFS) with minimum 40 cfm compressor.
Additional personnel

Source: NWCG, *Equipping Fire Apparatus for Use in Wildland/Urban Interface* (1998)

Appendix I

Request for Special Query Report

July 28, 2008

Nathan Murphy
Ohio Fire Marshals Office
Fire Prevention Bureau
8895 E Main St
Reynoldsburg, OH 43068

Mr. Murphy,

I am writing to request a special query of the Ohio Fire Incident Reporting System data.

I have recently completed my last class of the EFO program through the National Fire Academy and I am currently working on my Applied Research Project. The research topic I have chosen is a comparative analysis on the resource typing definition of engines (pumpers) as published by the National Integration Center (NIC) against the actual configurations of engines (pumpers) in the State of Ohio, specifically Cuyahoga County

My intent is to determine how engines have actually been utilized and what types of equipment configurations have been critical at major mutual aid events.

I am hopeful that results obtained from this research would be useful in representing the State of Ohio's interests when the engine typing definitions are reviewed and updated. At the very least, the State of Ohio has been recognized as a leader for their work in formulating a statewide mutual aid plan. I am hopeful that this project would serve to support an already great plan.

The specific OFIRS information requested:

Query parameters:
Years requested: 2003 – 2007
Mutual Aid: = given
Number of Engines: equal to or greater than 1

Appendix I (Continued)

Request for Special Query Report

Minimum Data needed:
FDID number
Date & Time of incident
Incident Location
Incident Location zip code

It would be most beneficial if the data could be obtained in an Excel format. However, I would be truly grateful to obtain the data in any format you could provide.

All information and correspondence will be acknowledged, cited and referenced in accordance to APA guidelines. In addition, I would gladly share the findings should you desire.

I thank you in advance for your consideration. Should you have any questions please feel free to contact me.

Respectfully,

Edwin D. Egut, Chief
Brecksville Fire Department
9023 Brecksville Road
Brecksville, Ohio 44141
[redacted]

Appendix J

Raw Data Received from Ohio Fire Marshals Office

(Sample)

Fdid	Alm_date	Alm_time	Inci_no	Exp_no	Inci_type	Descript	Number	St_prefix	Street	St_type	City	Zip
25009	01/01/07	9:55:00	7000196	0	611	Dispatched & cancelled en route	1099	W	1 AV		GRANDVIEW	43212
25009	01/01/07	9:55:00	7000196	0	611	Dispatched & cancelled en route	1099	W	1 AV		GRANDVIEW	43212
25009	01/01/07	2:03:00	7000079	0	611	Dispatched & cancelled en route	777		HARRISBURG PK		4	43222
80214	01/01/07	16:37:00	1	0	611	Dispatched & cancelled en route	625		Wagon Wheel	LANE	Marysville	43040
18061	01/01/07	4:40:00	1	0	111	Building fire	6871		GREENLEAF		Parma Hts.	44130
54003	01/01/07	5:12:00	2007001	0	111	Building fire	7431		wabash rd		Celina	45822
18081	01/01/07	4:30:00	10034	0	111	Building fire	6871		Greenleaf	AVE	Parma Hts.	44130
18073	01/01/07	12:40:00	1	0	730	System malfunction, Other	7490		WALTON	RD	Walton Hills	44
18019	01/01/07	4:50:11	4	0	111	Building fire	6871		GREENLEAF		PARMA HEIGHTS	44130
38017	01/01/07	18:28:00	2	0	111	Building fire	11401		TR 063		Killbuck Township	44654
25135	01/01/07	22:21:31	700002	0	611	Dispatched & cancelled en route	6769		Tussing	RD	Columbus	43232
25123	01/01/07	18:42:00	2	0	154	Dumpster or other outside trash receptacle fire	5780		TUTTLE GROVE		Dublin	43016
31103	01/02/07	11:31:00	9	0	700	False alarm or false call, Other	11967		Chase Plaza		Cincinnati	45240
25057	01/02/07	9:47:15	700005	0	611	Dispatched & cancelled en route	320	S	Hamilton	RD	Gahanna	43230
25057	01/02/07	9:47:15	700005	0	611	Dispatched & cancelled en route	320	S	Hamilton	RD	Gahanna	43230
31083	01/02/07	19:18:00	1	0	113	Cooking fire, confined to container	7800		Clovernook	AVE	Cincinnati	45231
18005	01/02/07	11:52:00	11	0	111	Building fire	22155		Libby		Bedford Hts.	44146
76003	01/02/07	17:43:00	2	0	111	Building fire	5156		State Route 212		Beach City	44608

Appendix K
Engine Attributes at Significant Events

To:
From: Chief Ed Egut
Subject: Engine Attributes

I am currently gathering information regarding the importance of Engine (pumper) equipment and configurations in mutual responses where three or more mutual aid engines responded. This research is being conducted for my National Fire Academy research project.

The Ohio Fire Incident Reporting indicated you had an incident that three or more mutual aid engines responded. It would greatly appreciated if you could rate the importance of the following engine attributes based upon your specific incident.

I understand that every engine may have not been utilized or, that the engines may have been utilized in different capacities and/or assignment. What I am attempting to determine is the significance of each attribute as it related to your specific incident.

Incident Date: **Location:**

Pump size over_____ gpm.

0 = Not a factor **1 = Factor** **2 = Significant Factor**

1” Booster Hose	_____	**4” Hose**	_____
1” Hose	_____	**5” Hose**	_____
1 ½” Hose	_____	**Either 4” or 5”**	
1 ¾” Hose	_____	**Hard Suction Hose**	_____
2” Hose	_____	**Portable Monitor**	_____
2 ½” Hose	_____	**Fixed Monitor**	_____
3” Hose	_____	**Class A or B Foam**	_____
		CAF System	_____

Thank you for your assistance!

Chief Ed Egut
Brecksville Fire Department

Appendix L

Engine Configurations

Please Fax Completed forms to: Chief Ed Egut [redacted]

Jurisdiction_____ Date:_____

FDID Number:_____

Number of Stations_____ Station No._____

Engine ID._____

Manufacture_____ Manufacture Date_____

Pump Capacity:_____gpm.

Total 1” Booster Hose _____ft.

Total 1” Hose _____ft.

Total 1½” Hose_____ft.

Total 1¾ Hose_____ft.

Total 2” Hose _____ft.

Total 2½ Hose_____ft.

Total 3” Hose_____ft.

Total 4” Hose_____ft. Fittings: Storz____ Threaded___

Total 5” Hose_____ft. Fittings: Storz____ Threaded___

Hard suction: size_____ Total ft:_____

Monitor: Fixed_____ Portable_____ Combination_____

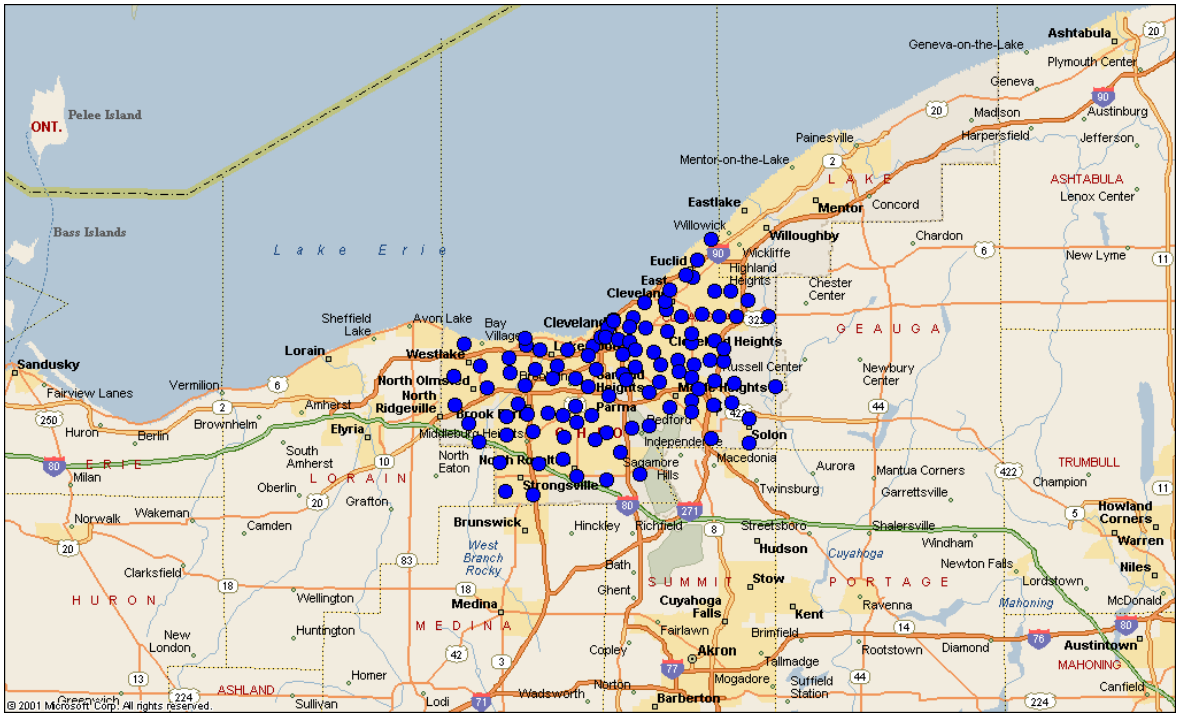
Special Features (Foam/CAF)_____

_____

Information By:_____

Appendix M

Cuyahoga County, Ohio, Fire Stations



Document created using *Microsoft Streets & Trips 2002*
Note: Document intentionally reduced for security purposes.

Appendix N
Engine Attribute Data

Unit ID	Year	Make	Pump Capacity	1" Booster	1" Hose	1 1/2"" Hose	1 3/4 Hose	2" Hose	2 1/2" Hose	3" hose	4" hose	5" Hose	Thred	Storz	Hard Suction	Hard Suction Size	Monitor	Foam
E-14	1996	Sutphen	1,500	0	0	100	800	0	250	800	0	800	0	1	0		Comb	
E-15	1997	LTI	1,500	0	0	100	800	0	250	1,600	0	0	0	0	0		Comb	
E-1012	1998	Pierce	1,500	0	0	100	600	0	800	0	0	600	0	1	0		Fixed & Portable	
E-1011	1996	KME	1,500	0	0	100	600	0	800	0	0	600	0	1	0		Fixed & Portable	
E-12	2007	E-One	1,500	0	0	0	1,100	200	600	0	1,075	0	0	1	0		Comb	
E-13	1996	Pierce	1,500	0	0	0	1,100	200	600	0	1,075	0	0	1	0		Comb	Class A & B
E-10	2006	Pierce	1,250	0	0	0	800	0	300	0	1,500	0	0	1	0		Comb	
E-9	1998	Pierce	1,250	200	0	0	700	0	300	0	1,500	0	0	1	0		Comb	
E-4	1994	Sutphen	1,500	200	0	0	800	0	1,000	600	0	0	0	0	0		Fixed	
E-1	2005	Pierce	2,000	0	0	0	850	0	1,000	600	0	0	0	0	0		Fixed	Class B
E-142	2008	Sutphen	2,000	0	0	0	1,200	200	300	1,000	0	1,090	0	1	20	6 inch	Comb	Class A & B
E-143	1992	Pierce	1,500	0	0	0	1,400	0	500	850	0	2,050	0	1	20	6 inch	Comb	Class B
E-1976	1986	Pierce	750	0	0	0	650	0	600	0	0	900	0	1	0		None	
E-1975	1989	Pierce	1,500	0	0	0	1200	0	1200	0	0	1,100	0	1	0		Comb	
E-2	1993	Sutphen	2,000	0	0	100	1,000	0	950	200	0	650	0	1	0		Comb	Class B
E-3	2002	Sutphen	2,000	0	0	100	1,000	0	950	200	0	650	0	1	0		Comb	Class B
E-4	1986	Pierce	1,500	0	0	100	700	0	750	300	0	550	0	1	0		Comb	
E-1	1989	American LaFrance	1,250	200	0	0	500	250	900	0	900	0	0	1	0		Fixed	
E-2	1999	E-One	1,500	0	0	0	500	250	900	0	900	0	0	1	0		Comb	F-500
E-3	1981	American LaFrance	1,250	0	0	0	500	250	900	0	900	0	0	1	20	6 inch	Fixed	
E-47	1995	E-One	1,500	0	0	0	800	0	1,150	0	600	0	0	1	0		Comb	F-500
E-50	1980	Sutphen	1,250	200	0	0	800	0	1,350	0	525	0	0	1	0		Portable	
E-1	1995	E-One	1,250	0	0	0	1,000	0	700	0	0	1,000	0	1	10	6 inch	Comb	
E-2	2001	E-One	1,250	0	0	0	500	0	500	0	0	2,500	0	1	20	6 inch	Comb	
E-1	2001	Laverne	1,500	200	0	0	700	400	500	200	600	0	1	0	20	6 inch	Comb	
E-4	2000	Laverne	1,500	200	0	0	500	500	500	100	500	0	1	0	20	6 inch	Comb	

E-6	2005	Laverne	1,500	200	0	0	400	200	300	200	500	0	1	0	0	Comb	
E-10	2002	Laverne	1,500	200	0	0	400	400	500	200	600	0	1	0	0	Comb	
E-11	2001	Laverne	1,500	200	0	0	300	350	650	200	600	0	1	0	0	Comb	
E-13	2002	Laverne	1,500	200	0	0	500	500	300	200	600	0	1	0	0	Comb	
E-17	2007	Crimson	1,500	200	0	0	600	400	0	300	600	0	1	0	0	Comb	
E-20	2007	Crimson	1,500	100	0	0	800	600	300	100	700	0	1	0	0	Comb	
E-21	2002	Laverne	1,500	150	0	0	500	300	200	200	500	0	1	0	20	6 inch	Comb
E-22	1999	General	1,500	200	0	0	600	300	200	300	575	0	1	0	0	Comb	
E-23	2002	Laverne	1,500	250	0	0	750	500	0	200	500	0	1	0	0	Fixed	
E-24	1999	General	1,500	200	0	0	700	400	0	200	600	0	1	0	0	Conb	
E-26	2002	Laverne	1,500	200	0	0	800	300	500	300	600	0	1	0	0	Fixed	
E-30	1995	Simon-Duplex	1,500	200	0	0	600	300	0	300	600	0	1	0	0	Fixed	
E-31	2001	Laverne	1,500	200	0	0	700	400	500	300	600	0	1	0	0	Comb	
E-33	2004	Rosenbauer	1,500	100	0	0	600	400	400	0	400	0	1	0	0	Fixed	
E-36	2007	Crimson	1,500	200	0	0	600	400	400	200	600	0	1	0	0	Comb	
E-38	1999	General	1,500	200	0	0	850	400	500	200	600	0	1	0	0	Comb	
E-39	2001	General	1,500	100	0	0	900	500	500	0	600	0	1	0	0	Comb	
E-40	2005	Rosenbauer	1,500	200	0	0	1,200	400	0	100	600	0	1	0	0	Fixed	
E-41	2004	Rosenbauer	1,500	200	0	0	600	400	600	200	600	0	1	0	0	Fixed	
E-42	2005	Rosenbauer	1,500	150	0	0	600	600	200	200	500	0	1	0	0	Fixed	
E-43	1995	LTI	1,500	100	0	0	600	600	400	0	600	0	1	1	0	Fixed	
E-12	1993	Pierce	1,500	0	0	0	500	0	400	0	1,000	0	0	1	0	Fixed	Class B
E-211	2003	E-One	1,500	0	0	0	1,250	0	750	0	750	0	0	1	0	Comb	Class B
E-212	1991	E-One	1,500	0	0	0	1,250	0	1,000	0	950	0	0	1	0	Comb	
E-222	1998	E-One	1,500	0	0	0	550	0	300	0	500	0	0	1	0	Fixed	
E-26	2000	Sutphen	1,500	0	0	0	300	0	200	0	1,500	0	0	1	0	Fixed	
E-27	1993	Sutphen	1,500	200	0	0	500	0	400	0	1,000	0	0	1	0	Comb	
E-111	2001	Ferrara	1,500	0	0	0	800	0	200	600	1,000	0	0	1	0	Portable	
E-112	2000	Ferrara	1,500	0	0	0	800	0	200	600	1,000	0	0	1	0	Portable	
E-2	2007	KME	2,000	0	0	0	925	0	750	0	0	1,085	0	1	0	Comb	
E-3	1992	Sutphen	2,000	0	0	0	1,100	0	700	0	0	1,100	0	1	0	Comb	
E-34	1995	KME	1,500	0	0	0	600	0	0	800	0	500	0	1	0	None	
E-35	2008	KME	1,500	0	0	150	750	0	200	1,000	0	600	0	1	0	Comb	Class B

E-1	2000	Ferrara	1,500	0	1000	0	800	0	0	500	800	0	0	1	0		Comb	Class A & B
E-1412	1996	Spartan	1,500	0	0	400	350	0	400	0	0	1,350	0	1	20	6 inch	Comb	Class B
E-1413	1987	Pierce	2,000	0	0	500	350	0	0	475	0	2,075	0	1	30	6 inch	Comb	
E-1411	1990	Salisbury	750	0	0	600	0	0	350	0	0	1,075	0	1	20	6 inch	None	
E-1	2001	Pierce	1,250	0	0	500	300	0	600	0	500	0	0	1	0		Comb	
E-2	1990	Grumman	1,500	200	0	500	300	0	600	0	500	0	0	1	0		Fixed	
E-811	1988	Sutphen	1,500	0	0	600	600	0	800	50	0	800	0	1	0		Comb	
E-812	1998	Sutphen	1,500	0	0	0	800	700	800	0	0	800	0	1	0		Comb	
E-1	1997	Pierce	1,500	0	0	0	1,000	0	400	1,000	0	800	0	1	0		Comb	
E-2	1981	Sutphen	1,500	0	0	450	0	0	250	1,000	0	800	0	1	0		Portable	
E-1	2005	Sutphen	1,500	0	0	0	750	0	0	600	650	0	0	1	0		Comb	
E-4	1983	Sutphen	1,500	50	0	0	750	0	0	600	600	0	0	1	20	6 inch	Portable	
E-2	1997	Sutphen	1,500	0	0	200	950	0	550	600	600	0	0	1	0		Comb	
E-3	1991	Pierce	1,500	0	0	0	800	0	600	100	600	0	0	1	0		Fixed	
E-5	1983	Sutphen	1,500	100	0	0	1,150	0	0	600	600	0	0	1	40	4 inch & 6 inch	Portable	
E-411	2004	E-One	2,000	0	0	0	800	250	0	500	0	1,500	0	1	20	6 inch	Comb	Class A
E-1	2006	Pierce	1,250	250	400	100	950	0	1,050	0	1,050	0	0	1	0		Comb	
E-3	1995	Sutphen	1,500	250	0	100	950	0	1,050	0	1,050	0	0	1	0		Comb	
E-2	2002	Maple	1,500	250	400	100	950	0	1,050	0	1,050	0	0	1	0		Comb	
E-512	2004	E-One	1,500	0	0	0	600	0	800	150	0	750	0	1	0		Fixed	
E-511	1989	Pierce	1,500	0	0	0	800	0	800	150	0	650	0	1	0		Comb	
E-611	1989	Pierce	2,000	0	0	0	650	250	450	600	0	1,575	0	1	0		Comb	
E-614	1997	E-One	750	0	150	0	200	350	0	0	500	0	0	1	0		None	Class A
E-2522	1980	Sutphen	1,500	0	200	0	300	300	400	500	0	500	0	1	0		Comb	
E-2521	1990	Pierce	1,500	0	200	0	300	300	400	500	0	500	0	1	0		Comb	Class B
E-50	1989	Pierce	1,500	0	0	0	1,200	250	700	0	1,000	0	1	0	0		Fixed	
E-3	1994	KME	1,500	0	0	0	600	0	500	0	0	600	0	1	0		Comb	Class A
E-2	2003	Pierce	1,500	0	0	0	600	0	600	0	0	600	0	1	0		Comb	Class A
E-1	1999	Ferrara	1,250	200	0	0	350	0	1,100	0	1,200	0	0	1	0		Comb	
E-2	2002	Pierce	1,250	0	0	0	1,350	0	0	800	1,050	0	0	1	0		Portable	CAF
E-1	1995	Pierce	1,500	0	0	0	1,050	0	950	0	1,050	0	0	1	0		Fixed	

E-4	2000	KME	1,250	0	0	0	850	0	300	0	1,300	0	0	1	0	Comb	
E-2	1993	Ouality	1,250	0	0	0	1,050	0	300	300	1,300	0	0	1	0	Comb	
E-4	2004	KME	1,500	0	0	0	1,050	0	450	0	0	1,075	0	1	0	Fixed	Class A & B
E-5	2000	E-One	1,500	0	0	0	1,000	0	200	0	0	900	0	1	20 6 inch	Comb	Class B
E-5	1998	Ferrara	1,250	0	0	100	550	0	300	0	0	500	0	1	0	Fixed	
	1993	Quality	1,250	0	0	100	550	0	600	0	0	2,000	0	1	20 6 inch	Fixed	
E-1	2001	Pierce	1,500	0	0	0	600	250	1,200	50	1,050	0	1	0	0	Comb	
E-7	1989	Pierce	1,500	0	0	0	600	250	1,200	50	1,050	0	1	0	0	Fixed	
E-8	1991	Pierce	1,500	0	0	0	600	250	1,200	50	1,050	0	1	0	0	Comb	
E-2	2001	Pierce	1,500	0	0	0	600	250	1,200	50	1,050	0	1	0	0	Comb	
E-4	1996	Pierce	1,500	0	0	0	500	250	1,200	50	1,050	0	1	0	0	Comb	
E-5	1996	Pierce	1,500	0	0	0	700	200	1,200	0	500	0	1	0	0	Comb	
E-8324	1981	Anerican LaFrance	1,500	0	0	0	800	0	500	0	800	0	1	0	0	Comb	
E-8321	1995	Sutphen	2,000	0	0	0	1,000	0	500	0	1,000	0	1	0	0	Comb	Class A
E-912	2006	Sutphen	2,000	0	0	0	950	0	0	300	0	1,650	0	1	20 6 inch	Comb	Class A
E-915	1991	Pierce	2,000	0	0	0	900	0	0	500	0	1,650	0	1	20 6 inch	None	
E-712	2007	Sutphen	2,000	0	0	0	600	0	400	0	0	1,000	0	1	0	Comb	Class B
E-65	1997	E-One	1,500	0	0	0	1,150	0	800	0	900	0	0	1	20 4 inch	Comb	
E-64	2005	E-One	1,500	0	0	0	1,000	0	950	0	900	0	0	1	20 4 inch	Comb	
E-1	2000	General	2,000	0	0	100	600	200	600	0	600	0	0	1	0	Comb	
E-2	2002	Ferrara	2,000	0	0	100	600	200	600	0	600	0	0	1	0	Comb	
E-3	1981	Anerican LaFrance	1,250	0	0	100	600	300	600	0	600	0	0	1	0	Fixed	
E-215	2001	Pierce	2,000	0	0	0	1,100	0	850	0	1,250	0	0	1	0	Comb	Class A
E-216	2003	Pierce	2,000	0	0	0	1,150	0	800	0	1,325	0	0	1	0	Comb	
E-1	2001	E-One	2,000	0	0	450	700	0	700	450	0	1,000	0	1	0	Comb	Class A
E-4	1988	Pierce	1,500	300	0	300	800	0	0	950	0	1,000	0	1	0	Comb	
E-2	2005	E-One	2,000	0	0	0	800	0	700	500	0	1,000	0	1	0	Comb	Class A
E-3	2003	E-One	2,000	0	0	0	750	0	225	350	0	1,030	0	1	0	Fixed	Class A
E-311	1999	Ferrara	1,500	0	0	0	600	0	650	0	850	0	0	1	0	Comb	Class A
E-312	2008	Pierce	1,500	0	0	0	600	0	650	0	850	0	0	1	0	Comb	Class A & B
E-6	1992	Pierce	1,250	0	0	0	550	0	650	0	1,000	0	0	1	0	Comb	
E-3	2000	E-One	1,500	0	0	0	550	0	900	0	1,100	0	0	1	0	Comb	Class B
E-4	2007	E-One	1,500	0	0	0	400	0	750	0	1,000	0	0	1	0	Comb	F-500
E-1112	1991	Pierce	1,500	0	0	0	500	0	0	600	500	0	0	1	0	Comb	

E-32	2002 Pierce	1,500	0	0	0	800	0	700	0	1,100	0	0	1	20	6 Comb	Class A
E-35	1996 Pierce	1,500	0	0	0	850	0	1,000	0	800	0	0	1	20	6 Comb	
E-2	1996 E-One	1,250	0	0	100	950	0	350	500	1,075	0	0	1	0	Comb & Portable	
E-21	1989 E-One	1,500	200	0	0	950	0	350	500	1,070	0	0	1	0	Comb	
E-71	2008 KME	1,500	0	0	200	850	0	1,200	0	0	600	0	1	0	Comb	Class A & B
E-72	2008 KME	1,500	0	0	200	850	0	1,200	0	0	600	0	1	0	Comb	Class A & B
E-1	1994 E-One	2,000	0	0	0	800	0	400	0	0	1,100	0	1	0	Comb	

Appendix O

Mutual Aid Engine Data

Location	Pump Size	Booster Hose	1" Hose	1 1/2" Hose	1 3/4" Hose	2" Hose	2 1/2 " Hose	3" Hose	4" Hose	5" Hose	4" or 5" Hose	Hard Suction	Portable Monitor	Fixed Monitor	Foam	Mutual Aid Engines
1500 Belmar	1,250	0	0	0	2	0	2	0	2	0	0	0	0	0	0	4
7148 Rustic Oval	1,250	0	0	0	2	0	2	0	2	0	0	0	0	0	0	3
7251 Engle	1,500	0	0	0	1	1	2	2	0	0	2	0	0	0	0	3
6871 Greenleaf	1,500	0	0	0	2	0	0	0	2	0	0	0	0	0	0	3
6855 W. 130th	1,500	0	0	0	1	0	2	0	2	0	0	0	0	0	0	4
2885 Pease	1,500	0	0	0	2	0	2	0	0	0	2	0	0	0	0	4
3836 Woodpath	1,500	0	0	0	2	0	2	0	0	0	2	0	0	0	0	3
28550 Westlake Village	1,500	0	0	0	2	0	2	0	0	0	2	0	0	0	0	3
4848 Chaincraft	1,500	0	0	0	0	0	1	2	0	0	2	0	2	2	0	8
5410 East 71	1,500	0	0	0	2	0	0	1	2	0	0	0	0	0	0	3
15711 Libby Rd.	1,250	0	0	0	1	0	1	0	0	0	1	0	0	0	0	3
26061 Cambridge	1,250	0	0	1	2	0	1	0	2	0	0	0	0	0	0	3
Heisley Rd	1,500	0	0	0	0	0	1	1	0	0	2	0	2	0	2	7
7277 Northfield Rd	1,250	0	0	0	0	0	2	0	0	0	2	0	2	2	0	4
Lee & Libby	1,250	0	0	0	0	0	2	0	0	0	2	0	1	0	0	5
3932 East 41	1,250	0	0	0	2	2	0	0	2	0	0	0	0	2	0	3
4017 East 42	1,250	0	0	2	0	0	0	0	2	0	0	0	0	0	0	3
4224 McGregor	1,250	0	0	0	2	2	0	1	2	0	0	0	1	0	0	3
3404 West 231	1,500	0	0	0	2	0	0	0	0	0	1	0	0	0	0	3
6023 Forest Ridge	1,500	0	0	0	1	0	1	0	0	2	0	0	0	0	0	3
130 Northfield	1,500	0	0	0	2	0	0	0	2	0	0	0	2	0	0	3
31 Mapledale	1,500	0	0	0	2	0	0	0	2	0	0	0	0	0	0	3
691 Lincoln	1,250	0	0	0	2	0	0	0	2	0	0	0	0	0	0	3
531 Solon Rd	1,250	0	0	0	2	0	0	0	2	0	0	0	0	0	0	3
1336 Caryl Drive	1,250	0	0	0	2	0	0	0	2	0	0	0	0	0	0	3
51 Crestwell	1,250	0	0	0	2	0	0	0	1	0	0	0	0	0	0	3

178 Talbot	1,250	0	0	0	2	0	0	0	1	0	0	0	0	0	0	3
26945 Bagley Rd	1,500	0	0	0	2	0	2	0	0	2	0	0	0	0	0	3
20905 Aurora Rd	1,250	0	0	0	1	0	2	2	0	0	2	0	0	0	0	5
17706 Miles Ave	1,250	0	0	0	2	0	0	2	0	0	0	0	0	0	0	3
7400 Wall Street	1,500	0	0	0	2	0	2	0	0	2	0	0	0	0	0	3